RAILROAD GAZETTE

FRIDAY, DECEMBER 8, 1899.

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Contributions.

The Charles River Bridge.

The Pennsylvania Steel Company,
Steelton, Pa., Nov. 30, 1899.

To the Editor of the Railroad Gazette:

We note an article in your paper of the 24th November entitled the "Charles River Drawbridge at Boston." In giving credit you state that the metal work was furnished by the Pencoyd Iron Works, whereas two of the approach spans and the draw span, which is 240 ft. long and 100 ft. wide, were built by this company. We believe the Pencoyd works furnished a portion of the plate girder approach, which, however, forms no portion of the descriptive matter in your article.

J. V. W. REYNDERS, Superintendent.

Malleable Iron Crossties.

To the Editor of the Railroad Gazette:

In regard to the use of malleable castings for railroad crossties, we are of the opinion that the cost would be prohibitive as long as a wooden tie of any kind can be procured. The immense possibilities of cultivated timber by an enlightened system of forestry in this country, and also a closer contact and greater opportunity of commerce with South America, will probably defer the absolute extinction of the wooden tie far beyond the present generation, so that it is more a theory than a condition about which we would have to worry. The mechanical difficulties of making, annealing and straightening malleable crossties would be very considerable.

MALLEABLE.

Normal-Clear and Normal-Danger.

To the Editor of the Railroad Gazette:

I have read with interest your report of the meeting of the Railway Signaling Club at Boston on page 804 of your issue of Nov. 24. I notice that you omit one significant point in connection with the use of automatic signals standing normally at danger, and that is the important exceptions which the advocates of that principle admit. By referring to the verbatim report of the discussion you will recall that prominent members of the Club, who use signals in that way, admitted that at one point or another they used the normal clear system. In one case this was said to have been necessary because of congested traffic. Where trains follow one another very closely the normal danger complication is bothersome, and at the best is useless. In another case the normal clear method appears to be retained at one place because it is a place of special danger. It strikes me that in thus modifying their practice to fit conditions which are very common the normal-danger people gave away their case.

NORMAL CLEAR.

The Track of a Cross Country Railroad.

To the Editor of the Railroad Gazette:

I live near a railroad junction and occasionally stroll along the tracks, and wish to tell your readers of some of the things that I have lately observed. The line in question is not a main line, even in this section of the country, but it is an important branch over 100 miles long, used somewhat by the main line for through freight, having considerable local freight business and running two passenger trains a day. The passenger trains make 80 miles in three hours, including several stops, and get up to well over 30 miles an hour while running.

The rail is 50 lbs. to the yd., laid without ballast, on earth varying from sand to red and yellow clay. There are 14 ties to a 30-ft. rail. The ties were originally small and have been in the track for a number of years, and in many cases three or four inches is all the bearing the rail gets on a tie, many of which are considerably decayed.

The joints are fairly good, except that many of them are open from ¾ of an inch to an inch. The spikes I have found generally standing with the heads from ¼ of an inch to ¾ of an inch above the flange of the rail. In many cases the finger (not a small one) could be run between the head of the spike and the base of the rail. This is not sometimes, but usual. I counted 12 spikes in succession that stood from ¼ of an inch to one inch above the rail; that is, 12 spikes out of 14.

The surface and line are fairly good. The curves are probably from four to six degrees, the steepest grades from 60 to 75 ft. per mile.

In walking over this track I wondered what an engineer ought to do about it. If I should mention it to one of the officers of the road I should be thought impertinent. As a matter of fact, trains seem to get over this road without accident.

Observation of this track confirms the impression that I have had for a good while, that derailments attributable solely or mainly to the condition of the track—that is, to spreading or turning of rails—are much rarer than is generally supposed. The condition of the track in question offers strong confirmation of this view and of the belief that most derailments come from a break-down of the running gear, or falling of a brakebeam, or something of the sort.

SUBSCRIBER.

The Theory of Velocity Grades.

Roanoke, Va., Nov. 30, 1899.

To the Editor of the Railroad Gazette:

There are questions connected with velocity grades, and their advantage in handling tonnage, that are tedious to answer, figuring from first principles. The following may be found convenient in such cases:

The relation between the factors that make up the situation may be expressed by the following formula:

in which $$T = \frac{0.5\,(P_1 + P_2)\,L}{R\,L + 20\,G\,L - \frac{1}{2}\,(S_1^2 - S_2^2)} \quad \text{I.}$$

T = greatest weight of train, including engine and tender, in tons of 2,000 lbs., that can be handled under the conditions given.

S_1 = initial speed in miles per hour; or the speed at which the train is moving when its center of gravity is at the beginning of the distance L.

S_2 = final speed in miles per hour. This is the speed of the train when its center of gravity is at the end of the distance L.

L = length of track, in stations of 100 ft. each, in which the speed varies from S_1 to S_2.

P_1 = traction of the engine in pounds, at the rails, when moving at the speed S; the engine being supposed to be exerting all the traction it can at that speed.

P_2 = the same at speed S_2.

R = average resistance of friction, in pounds per ton, for the entire train.

G = rate of grade, in feet per station, which is uniform for the distance L. G is positive for an up grade, and negative for a down grade. On a level of course G is zero.

When the tractive power of an engine at varying speeds is known, formula I. may be used with correct results. Generally, however, this is not known, and it appears best to the writer to use in such cases an empirical expression for the traction that may be reasonably expected from an engine of given weight on driving wheels moving at a given speed. An accurate expression must necessarily include, not only the governing dimensions of the engine, but also a combined expression for the personal equations of the engineer and fireman, and the coal used. Especially is it better to use such an empirical formula when revising grades on an engine division, than to make use of the traction of a given engine that may become obsolete in a few months. The writer suggests the following as an expression for the traction in pounds, for an engine weighing D pounds on driving wheels:

$$P = \frac{4\,D}{S + 10} \quad \text{II.}$$

In this, S is the speed at which the traction, P, can can be exerted; S being over four miles per hour, and sand being used at slow speeds when necessary to increase adhesion.

In the following examples of the use of formula I., the weight of the engine on driving wheels, D, is taken at 150,000 lbs., and the values of P_1 and P_2 from formula II. are substituted; assuming that $P_1 = \frac{4\,D}{S_1 + 10}$ etc.

For a uniform speed we have $S_1 = S_2 = S$, and

$$T = \frac{600{,}000}{(S + 10)\,(R + 20\,G)} \quad \text{III.}$$

which is an expression for the total weight of the train that can be taken up a grade of G per cent. at a uniform speed, S.

If advantage is to be taken of the momentum of the train in overcoming the grade, and we assume an initial speed S_1 of 25 miles per hour reducing to $S_2 = 5$ miles per hour, and assume the average friction as 7½ lbs. per ton, we have

$$T = \frac{1{,}428\,L}{.375\,L + G\,L - 20} \quad \text{IV.}$$

in which T is the total weight of train that can be taken up the grade by the given engine with the given initial and final speeds of 25 and 5 miles per hour. The expression G L is the total rise in feet.

To find whether a desired initial speed can be attained for use on a given velocity grade, say 26 miles per hour, it must be determined whether the train can attain a final speed of 26 miles per hour at the end of the approach track to the given velocity grade. Assuming that the train can reach the approach with a speed of 6 miles per hour we have $S_1 = 6$ and $S_2 = 26$, and

$$L = \frac{426.6\,T}{27{,}150 - R\,T - 20\,G\,T} \quad \text{V.}$$

in which L is the distance required to get up a speed of 26 miles per hour from an initial speed of 6 miles per hour. If the grade is falling the last sign in the denominator is positive.

If it is desired to find the steepest grade by which a given train can ascend a given height, with an initial speed of 25 miles per hour and a final speed of 5, we have, calling the total rise H,

$$L = \frac{T\,(H - 20)}{1{,}428 - .375\,T} \quad \text{VI.}$$

This gives the minimum length of the grade L, from which, with the total rise, the maximum rate of grade can be calculated.

If a train starts up a grade of indefinite length with a given speed, there is a point at which the momentum is expended, and from there on the engine must overcome the remainder of the grade by traction only, unassisted by momentum, in order to reach the summit. To locate this point for any given grade make S = (say) 5 in equation III, and substitute the resulting value of T in equation IV. Then if R is taken at 7½ lbs. per ton we have after transposing

$$L = \frac{186.5}{2\frac{1}{2}\,G + 1} \quad \text{VII.}$$

This gives the maximum length of velocity grades of given rate G. Longer grades come under the equation III. If some other value of S had been assumed in equation III. the maximum length of velocity grade would be altered; but in any case the length is such that just as many total tons can be taken up by taking a run at the grade of 25 miles per hour, reducing to 5, as by a steady pull at the speed assumed. In this case, however, an assumed uniform speed of eleven miles per hour can not be exceeded, as greater assumed speeds result in a negative value for L which is of no practical utility.

Formulas I. and II. may be combined and written

$$T = \frac{3\,D\,L\left(\frac{1}{S_1 + 10} + \frac{1}{S_2 + 10}\right)}{1.5\,R\,L + 30\,G\,L - (S_1^2 - S_2^2)} \quad \text{VIII.}$$

This formula contains seven variables, any six of which being known the seventh can be found. Formula II. appears to fairly represent traction within the limits of variation met with in practice, and may be brought in line with any given actual figures by slight alteration of the constants. Of course any expression for traction in pounds may be substituted for P_1 and P_2 in formula I.; and the more correct the expression the more correct will be the results.

CHAS. C. WENTWORTH,
Bridge Engineer, Norfolk & Western Railway.

Colors of Heated Steel Corresponding to Different Degrees of Temperatures.*

There is, perhaps, nothing more indefinite in the industrial treatment of steel, than the so-called color temperatures. . . .

The temperatures corresponding to the colors commonly used to express different heats are so widely different as given by different authorities, it is impossible to draw any definite or reliable conclusion. The main trouble seems to have been in the defective apparatus used for determining the higher temperatures. The introduction of the Le Chatelier pyrometer within the last few years has placed in the hands of the scientific investigator an instrument of extreme delicacy and accuracy, which has enabled him to determine the temperatures through the whole practical range of influence, and led to the establishment of new melting and freezing points of various metals and salts, which are now accepted as the standard in all scientific investigation. There have not, however, been published any results with

*By Maunsel White and F. W. Taylor, Bethlehem, Pa. Presented at the New York meeting (December, 1899) of the American Society of Mechanical Engineers.

the Le Chatelier pyrometer seeking to establish a correspondence of temperatures with color heats.

The first work done in this line, of which we are aware, is that of Dr. H. M. Howe, some eight or nine years ago. His results, however, have not been published, and with his kind permission we are enabled to give them here:

Dull red	625° to 550° C.	1,022° to 1,157° Fahr.
Full cherry	700°	1,292°
Light red	850°	1,562°
Full Yellow	950° to 1,000°	1,742° to 1,832°
Light yellow	1,050°	1,922°
Very light yellow	1,100°	2,012°
White	1,150°	2,102°

The nomenclature used for color heats differs with different operators, but in our investigation we have adopted that which seems more nearly to represent the actual color corresponding to the heat sought to be represented. We have found that different observers have quite a different eye for color, which leads to quite a range of temperatures covering the same color. Further, we have found that the quality or intensity of light in which color heats are observed—that is, a bright sunny day, or cloudy day, or the time of day, such as morning, afternoon, or evening, with their varying light—influence to a greater or less degree the determination of temperature by eye.

After many tests with the Le Chatelier pyrometer, and different skilled observers working in all kinds of intensity of light, we have adopted the following nomenclature of color scale with the corresponding determined values in degrees Fahr. as best suited to the ordinary conditions met with in the majority of smith shops:

Dark blood red, black red	990°
Dark red, blood red, low red	1,050°
Dark cherry red	1,175°
Medium cherry red	1,250°
Cherry, full red	1,375°
Light cherry, bright cherry, scaling heat, light red	1,550°
Salmon, orange, free scaling heat	1,650°
Light salmon, light orange	1,725°
Yellow	1,825°
Light yellow	1,975°
White	2,200°

. . . The importance of knowing with close approximation the temperatures used in the treatment of steel cannot be overestimated, as it holds out the surest promise of success in obtaining desired results. This demand for more accurate temperatures must eventually lead to the use of accurate pyrometric instruments; but at present the only available instruments do not lend themselves readily to ordinary uses, and the eye of the operator must be largely depended upon; therefore, the training of the eye, by observing accurately determined temperature, will prove of much material assistance in the regulation of temperatures which cannot be otherwise controlled.

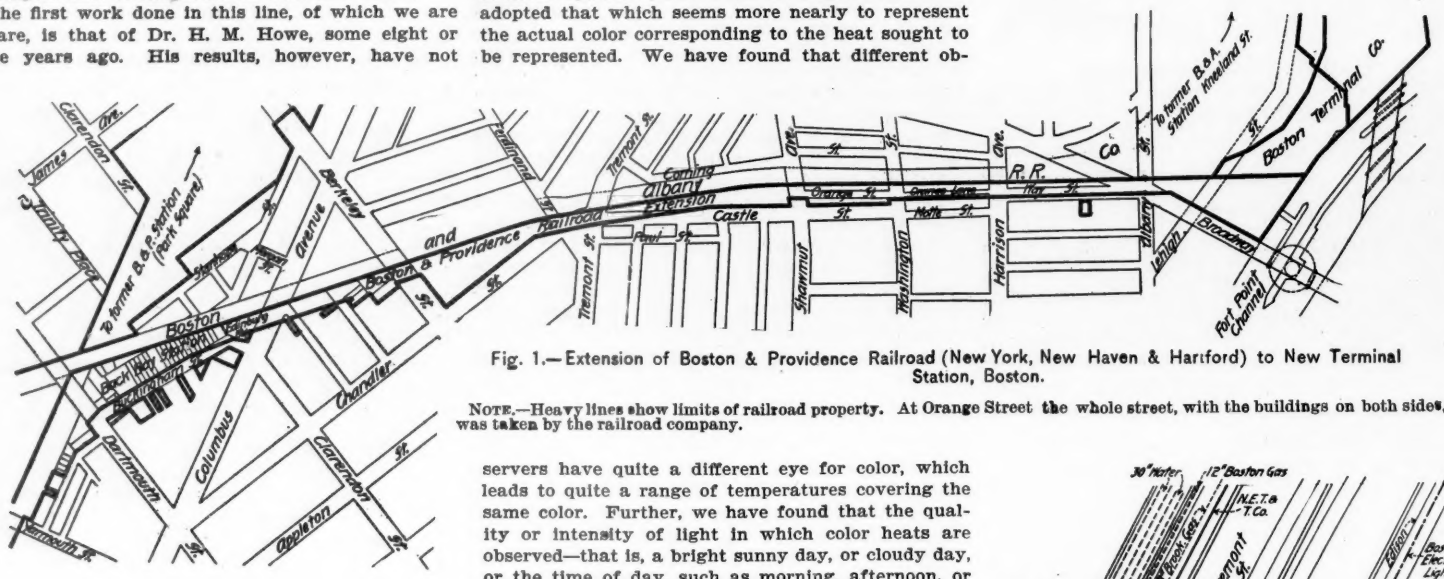


Fig. 1.—Extension of Boston & Providence Railroad (New York, New Haven & Hartford) to New Terminal Station, Boston.

NOTE.—Heavy lines show limits of railroad property. At Orange Street the whole street, with the buildings on both sides, was taken by the railroad company.

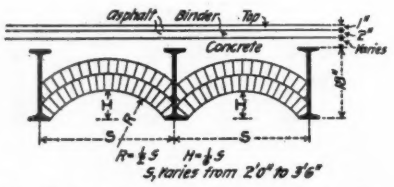


Fig. 3.—Typical Section of Floor at Castle Square.

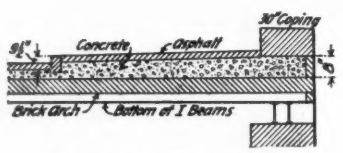


Fig. 13.—Detail of Fig. 10.

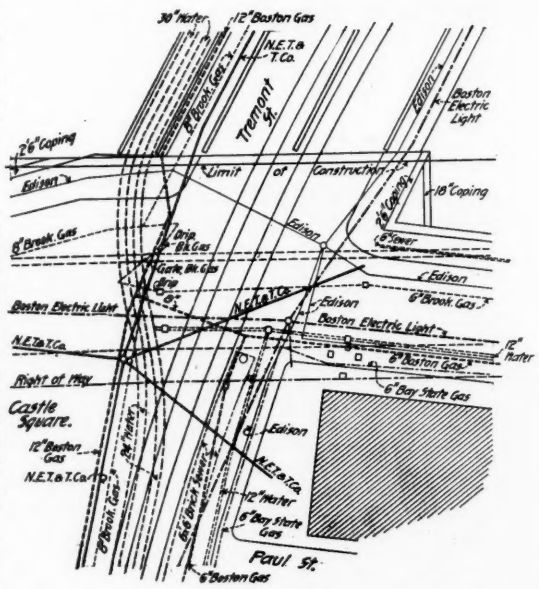


Fig. 2.—Electric, Gas and Water Conduits at Tremont Street (Castle Square).

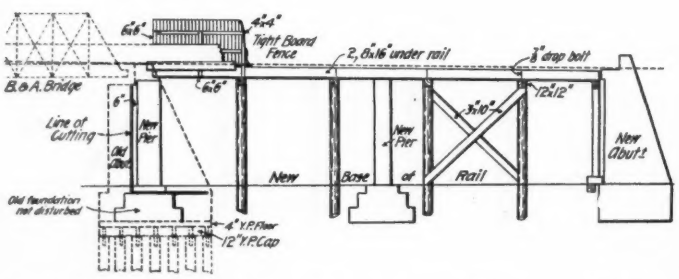


Fig. 8.—Temporary Bridge for West Half of Tremont Street.

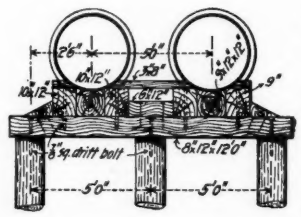
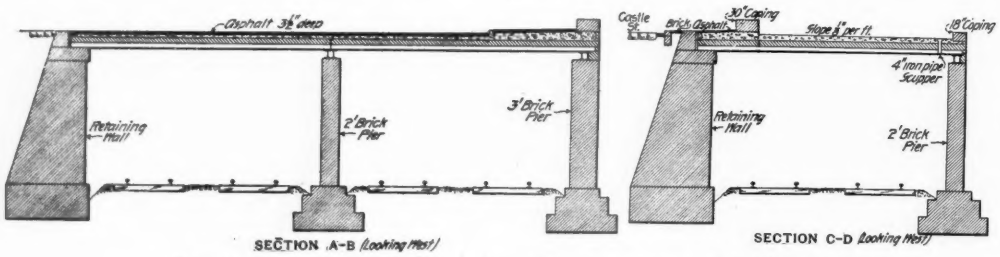


Fig. 9.—Temporary Bridge for 30-in. Water Pipes.



Figs. 10 and 11.—Street Floor and Foundations for Same at Castle Square.

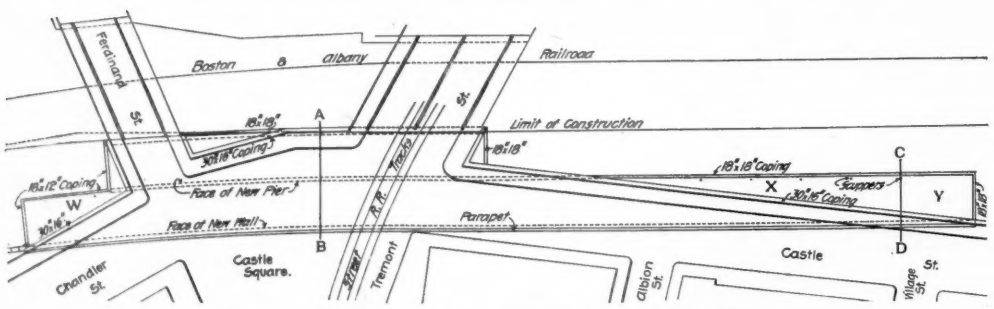


Fig. 12.—Lines of Streets and Supporting Walls at Castle Square.

NOTE.—The line marked "Limit of Construction" indicates the southern boundary of the Boston & Albany right of way. The B. & P. right of way, between this and the line marked "Parapet," had all to be excavated a depth of about 15 ft. The central pier, at a point near "X" is shown in Fig. 7.

The "Boston & Providence Extension."

The extension of the Providence Division of the New York, New Haven & Hartford (owned by the Boston & Providence) from Huntington Avenue, Boston, to the new South Terminal, lately finished, is one of the most expensive features of the consolidation of all the passenger stations in the southern part of Boston into one, and undoubtedly there are very few single miles of railroad in the United States which cost more than this. The work of building this extension has involved some delicate problems in engineering. It has also necessitated a great number of the usual legal contests with land owners, but that is not a part of our present subject.

The extension begins at a point where formerly the B. & P. crossed the Boston & Albany, and the line runs parallel to the B. & A., and on the south or right-hand side of it, to Albany Street and Broadway, near the former B. & A. passenger terminal, a distance of about 4,000 ft. Thence easterly to the limits of the Terminal yard, 500 ft., both the B. & P. and the B. & A. have new lines, side by side. The B. & P. line is four-track all the way, and practically the whole of the three-quarters of a mile first mentioned is on ground which was covered with solid rows of brick dwellings and other buildings four stories high, or higher; and some of them were six stories. Most were houses 25 to 50 years old, but many were more modern. The line from Huntington Avenue to Albany Street is below the natural grade, and the old retaining walls on both sides of the B. & A. for a large part of the distance, surmounted by dwellings, have been a familiar landmark of the city of Boston to thousands of travelers for 40 years and more. There are ten overhead bridges, one at each of the several streets shown in the sketch plan. Washington and Tremont are the two chief streets of the city, and these crossings are not far from the busiest portions of these streets.

The western portion of this line is below high-water level in the bay, and the Boston & Albany tracks have been submerged occasionally ever since they were built. At Tremont Street the tops of the rails are 3.6 ft. below high water. The difficulty comes when an east wind, raising the level of the water in the harbor, a heavy rain and a high tide happen at the same time. A reservoir has had to be provided to gather the surplus water, to be discharged into the sea at low tide.

A large portion of this line is on artificial ground. The Boston & Albany (Boston & Worcester) line, built in 1833, was for a long distance surrounded by the water of the bay on both sides, and the surrounding submerged flats have been gradually filled in as the city grew. The ground being of this nature, the foundations of all retaining walls, bridge piers and reconstructed buildings had to be made on piles.

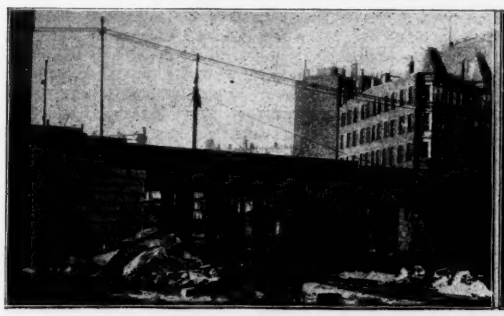


Fig. 4.—Berkeley Street, from the East.

Fig. 5.—Pipes at Harrison Avenue (West Half Only).

Fig. 6. Washington Street, Old and New Bridges.

The four tracks of the extension, two for suburban passenger trains and two for through passenger trains, are laid with the company's 100-lb. standard steel rails, with sleepers 6 in. x 9 in. laid in rock ballast, 3,168 sleepers to the mile. Trains will be run by the aid of electrically controlled manual block signals, the latest apparatus of the Union Switch & Signal Company being used throughout the length of this division, Boston to Providence, 44 miles.

The point where the extension leaves the former main line is the location of the "Back Bay Station," above the tracks, which was described in the Railroad Gazette of March 18, 1898.

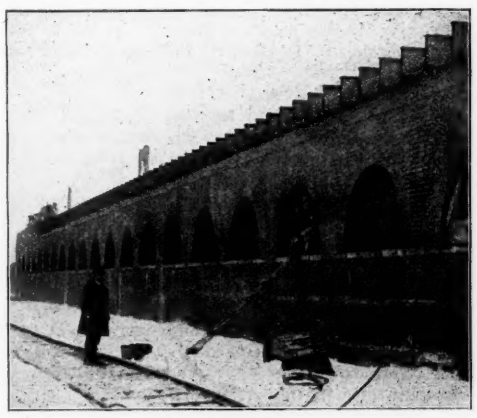


Fig. 7.—Pier Between Tracks at Castle Square.

On the left side, proceeding toward the Terminal Station, the new roadbed joins, at the same level, that of the Boston & Albany. The former abutments of the Boston & Albany bridges are supplanted by piers and in each case what is virtually a single bridge spans both railroads (except at Dartmouth Street and Castle Squire.) See Figs. 4 and 6.

The right hand or southerly side is marked by a continuous retaining wall, which affords the necessary support for the southerly ends of the bridges. In most cases the retaining walls were built in trenches and the earth in front was not carried off until after their completion. This was necessary because it was impossible to prepare suitable transportation facilities at the time the walls were begun. Nearly all of the wall was laid on a foundation of piles. These were generally about 30 ft. long, most of them being of spruce, 12 in. in diameter at the butt and 6 in. at the point; and they were driven to refusal. The masonry of the retaining walls is all coursed granite work, with copings of the same material. The bridges were made of the same design as those of the B. & A., as far as possible. In some cases the trusses of the old ones had to be shortened a little.

At the busiest streets wagon traffic had to be provided for continuously without interruption, and the work was somewhat difficult. These streets have numerous water and gas pipe lines and conduits. (See Figs. 2 and 5.) The piers and abutments had to be built for one-half the street at a time. Before this could be done, however, it was necessary to build a temporary bridge for the other half; and, to further complicate matters, the street grades had to be raised from two to six feet. In connection with this change of grade, the entrances to buildings and the masonry at areaways had to be changed to conform to the new level.

Fig. 8 is a sketch showing the temporary bridge for the west half of Tremont Street. It will be seen that more than half of the old abutment of the Boston & Albany bridge had to be cut away to make room for the new pier, while at the same time it had to be left with sufficient strength to carry its load. The floor timbers of the temporary bridge at this crossing were 6 in. x 16 in., laid 2 ft. apart center to center, but with timbers 2 in. thicker under the street-car rails. The transverse bracing was 3 in. x 10 in., the same as that shown in the elevation.

For the 30 in. water pipes a separate trestle was made at one side of the street. The construction of this is shown in Fig. 9.

Figs. 10, 11 and 12 show the way in which Castle Square was dealt with. At this point, the junction of Tremont, Ferdinand and Castle Streets, the street lines were left undisturbed and therefore the tracks of the extension run beneath the streets for several hundred feet. The angle between the line of the street and the line of the tracks is so acute that to make suitable supports for the street floors, long piers had to be built, as shown in Fig. 7. The lines of these piers are indicated on the drawing, Fig. 12. The photograph, Fig. 7, shows that portion of the middle pier near the letters X Y, Fig. 12. These piers are all of brick with stone footings, and they support iron beams laid transversely to the tracks. The area of bridge flooring laid on these beams at this point is about 2,700 sq. yds. The flooring is of concrete and asphalt, as shown in Fig. 13. The same style is used at several other bridges. The triangular floor spaces, such as those at W, X and Y, Fig. 12, are left vacant.

This work was done under a special act of the Massachusetts Legislature, approved June 16, 1896, the same which authorized the building of the South Terminal Station, the Back Bay Station and the new drawbridge across Fort Point Channel. The substructure of this drawbridge was built under the supervision of the same engineers who built the B. & P. extension. The abutments and the six piers of the drawbridge are all of granite, the piers being from 120 ft. to 160 ft. long. The masonry of the abutments is founded on piles cut off at low water level, while the piles for the piers were cut off 14 ft. below mean low water mark. The pier masonry was built in open caissons, two of which were used for each pier, owing to their great length. The sections of each pier were joined above the high water line by an arch. These caissons had bottoms (forming part of the permanent structure) of three layers of 12 in. x 12 in. timbers, and the sides, 30 ft. high, were framed and braced and covered with 2 in. plank. The superstructure of this bridge was described and illustrated in the Railroad Gazette of Aug. 4 and Sept. 8 last. It consists of three double-track through skew drawbridges, of the Scherzer Rolling-Lift type, and plate girder approaches. The operating tower is placed over the approach of the central span. Electric power, transmitted through an operating strut 60 ft. in length opens or closes the bridge.

The officers in charge of all this work were F. S. Curtis, Chief Engineer of the railroad company; R. M. Berrian, Engineer in Charge; E. J. Beugler, Principal Assistant, and C. R. Harte, Second Assistant.

[To be continued.]

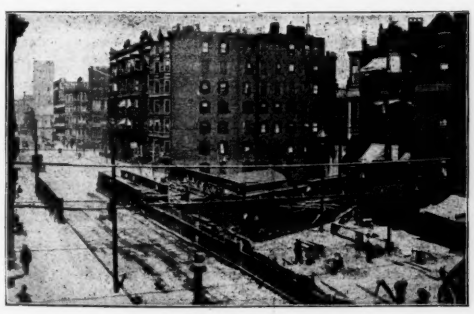


Fig. 14.—Columbus Avenue, Showing Maintenance of Traffic in Half of Street, and Beam Flooring.

Fig. 16.—Buckingham Street. North Side; All Torn Down. High Building in the Distance is "The Edinburgh."

Fig. 17.—Boston & Albany "Cut," East from Shawmut Avenue. On the Right are the Rears of Orange Street Houses, all Torn Down.

The Cost of Steel in Buildings.*

The total cost of the structural steel erected in a building depends upon the weight and the current quotations for the plain material, as well as upon the workmanship thereon, its hauling to and erection at the building site. The weight of structural steel in a building is very difficult to estimate, unless plans and specifications are first drawn up, as this will depend upon the design, the number of stories, the dead and live load to be carried per square foot of floor, the weight of brick or stone work resting on the outside girders, and the allowable unit stresses on the steel. While the allowable stresses per square inch are pretty well determined by our building laws, which are almost identical with each other, yet the former factors are of so wide range as to make each individual case different.

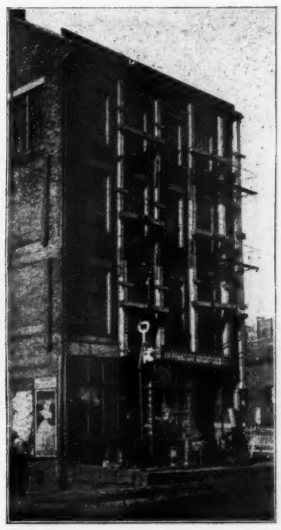


Fig. 15.—Safety Bracing on Old Building at Harrison Avenue and Mott Street. Part of the Building (at the Right) has been Torn Out.

However, for the weight of the steel skeleton of the average office building, whose walls are carried by the steel work, we have found by careful records of the weight of steel required that the following formula can be used with sufficient accuracy for preliminary estimates:

$W = N \times F\ (15 + \frac{1}{10} N)$, in which W is equal to the total weight in pounds of the structural material required; N is equal to the number of floors, including the roof as a floor, and F is the number of square

*An extract from a paper by F. H. Kindl, Structural Engineer, Carnegie Steel Company, Limited, presented at the thirty-third annual convention of the American Institute of Architects, Pittsburgh, Pa.

feet in each floor. The first number (15) inside of the parenthesis when multiplied by the factor N F, will give the weight of the beams and fittings required in the floors, while the second member (7/10 N) multiplied by the same factor represents the weight of the columns. Thus we have for the weight of the skeleton steel for such a building, having a floor area of 10,000 sq. ft. and 15 stories high (16 counting the roof), 2,400,000 lbs. of beam work and 1,792,000 lbs. of column work, or a total of 4,192,000 lbs. of steel work.

As regards the cost, while this will vary somewhat, due to design, we might safely assume that unless the construction is complicated, owing to an irregular lot line or unusual construction such as is found in theaters, music halls, etc., the average cost for fitting beams will seldom exceed one-half cent per pound above the price of plain material, including the painting, while for column work, 1¼ cents per pound above the price of plain material. We have, therefore, for our building noted above, assuming the price of plain material will average two cents per pound, the cost of the beams would be 2½ cents per pound, and that of the columns 3¼ cents per pound, or a total cost of the beams, $60,000; columns, $58,240, making a total amount of $118,240 for the steel work f. o. b. cars Pittsburgh, painted. To this must be added the cost of freight, hauling and erection. The hauling can generally be done for 50 cents per ton, while the erection will seldom exceed $6.50 per ton, thus making the hauling and erection $7 per ton. The hauling and erection of the steel for our building would therefore be $14,672, making a total cost of $132,912 for the steel work, erected in Pittsburgh, as per your plans and specifications. These figures are kept somewhat on the safe side, and appear high to-day, owing to having used a base price of two cents per pound for the plain steel, which, as you know, is almost double the market price of one year ago.

Since writing this paper the price of steel has again advanced and the cost of our building would now be very nearly $15,000 more.

Moisture in the Steam of Locomotives.

At the October meeting of the New York Railroad Club, Mr. Forney started a discussion on the above topic, which discussion we give below nearly in full:

Mr. Forney: A short time ago a gentleman called on me and submitted a patent of a steam separator, which is the invention of a German and is intended for use on locomotives, and my opinion was asked in regard to it. I tried to find out, in the first place, whether there was any considerable amount of moisture in the steam of locomotives, and to my surprise I found that nobody seemed to know anything very definite about it. I got track of some experiments which Mr. Barnes made some time ago on the Baltimore & Ohio Railroad, in which he tried a Barrus calorimeter on a locomotive, and he found that it did not indicate any moisture, and he then filled the boiler so full of water that it commenced to work out of the smokestack, and still his instrument did not indicate any moisture in the steam. He then went to work with an instrument of his own, which he had designed, and applied it to the locomotive, and found that it indicated a very small amount of water. Now, the deduction therefrom might be that perhaps his instrument did not indicate the amount of moisture any better than that of Mr. Barrus did, and I do not feel at all satisfied, from Mr. Barnes' test, that there is not a very considerable amount of water in the steam as we ordinarily work it in a locomotive. Of course, we all know that when you first turn steam into cold cylinders, the water condenses and a great deal of water is blown out. Mr. Gibbs, I think, of the Milwaukee & St. Paul road, in a report made to the Master Mechanics' Association, reported somewhat over 1 per cent. of water, and Mr. Barrus made a report and he also reported a very small amount of water. Notwithstanding this evidence, I am still unsatisfied about it. The Germans pretend that they can get an economy of about 8 per cent. from the use of this separator, and it is certain that the use of separators is very extensive on stationary engines, and they would hardly be used to the extent to which they are if there were not some decided advantage in them. From looking at the subject in a general way, it would seem to me that a locomotive boiler would be much more apt to have moist steam than a stationary boiler, and for that reason a steam separator on a locomotive ought to be of more value than on a stationary engine. But the question I want to get at this evening, and have propounded to this audience, is as to whether anyone present knows how much moisture there is in the steam used in locomotives under ordinary conditions of working.

Mr. F. M. Whyte: . . . I assisted in the tests made by Mr. Barnes on the Baltimore & Ohio, and my memory is quite clear on the subject to which Mr. Forney refers. The Barrus calorimeter was tried first, and a "home-made" throttling calorimeter was also tried, and the conclusions arrived at from the information obtained from the calorimeter readings was that, under usual conditions, the steam found in the dome of a locomotive boiler was from 98 to 99 per cent. dry; under unusual conditions, as when the water in the boiler is foaming from any cause, there is more moisture shown in the steam in the dome, and the amount may or may not be beyond the range of a throttling calorimeter. Other tests which I have made since the Baltimore & Ohio tests confirm the conclusion reached then, and given above, and the same conclusions have been confirmed by tests made by others. I know of no experiments which have been made to determine the quality of the steam in locomotive steam or "dry" pipes, but no doubt a fair conclusion would be that, with from 1 to 2 per cent. of moisture in the steam in the dome and the steam throttled to the steam pipe, as it is generally, all the moisture would be evaporated in passing through the partly open valve, if indeed, the steam would not be superheated somewhat. Mr. Forney said that a separator would be as desirable on a locomotive as on a stationary plant——

Mr. Forney: Excuse me; I did not say so; I simply said that it might be so.

Mr. F. M. Whyte: Generally, a separator is necessary for a stationary plant because the pipe connection between boiler and engine is very long when compared with the corresponding connection of a locomotive. Also, the steam pipe of a stationary plant is more exposed to colder media and more condensation must take place in a given length of it than in an equal length of the locomotive steam pipe. The locomotive steam pipe, from throttle to tube sheet, is exposed to a temperature corresponding to the pressure of the steam in the boiler, and from the tube sheet to the cylinder saddle it is exposed to a temperature which is, generally, considerably above the temperature of the steam in the pipe, so that the conditions of a locomotive should tend toward absorption of heat by the steam rather than a drawing of heat from the steam.

Prof. H. Wade Hibbard: I made some tests two or three years ago on some fair-sized consolidation engines in freight service at twenty miles an hour. With the use of the throttling calorimeter in the steam dome close to the throttle valve we got a wetness, according to my recollection, of about 5 or 6 per cent. Engines carried 180 pounds of steam. At the time those tests were made we remarked upon the excessive amount of moisture. It was more than would ordinarily be found, and we attributed it to the fact that they had been freshly through the shop and were oily inside.

(Contributed after the meeting.)

The following data have been taken from the records of the runs. Each run was for 45 miles. The first run for each engine was at a constant speed of 20 miles per hour, at approximately constant power up and down grade obtained by means of a second engine helping or retarding behind the dynamometer car. The second run for each engine was made without the additional engine, necessarily giving varying speed and horse power:

Simple engine 1, first run, 3.35 per cent. wetness average for entire run.

Simple engine 1, second run, 4.44 per cent. wetness average for entire run.

Two-cylinder compound engine 2, first run, 5.76 per cent. wetness average for entire run.

Two-cylinder compound engine 2, second run, 4.64 per cent. wetness average for entire run.

Two-cylinder compound engine 3, first run, 5.34 per cent. wetness average for entire run.

Two-cylinder compound engine 3, second run, 4.31 per cent. wetness average for entire run.

Two-cylinder compound engine 4, first run, 4.68 per cent. wetness average for entire run.

Two-cylinder compound engine 4, second run, 3.50 per cent. wetness average for entire run.

Simple engine 5, first run, 5.46 per cent. wetness average for entire run.

Simple engine 5, second run, 5.46 per cent. wetness average for entire run.

Mr. F. M. Whyte.—The calorimeter was placed in the dome?

Prof. Hibbard.—The calorimeter was in the steam dome, close to the throttle valve.

Mr. F. M. Whyte.—The calorimeter did not receive the steam beyond the throttle?

Prof. Hibbard.—No, just before it entered the throttle.

Mr. Forney.—I would like to ask the Professor whether it was an ordinary condition of working that class of engines, or were there some special reasons for it?

Prof. Hibbard.—The engines were working under ordinary conditions; but, as I said, they were fresh from the repair shop, fitted with new staybolts, newly ground joints, etc., that made the interior oily, and we had found in tests a few months before that, under those conditions in stationary practice, the percentage of moisture in the steam was greatly increased by oil in the interior.

Mr. Forney.—So it is possible that those were exceptional conditions?

Prof. Hibbard.—Yes; those were exceptional in that it indicated greater moisture than should have been indicated.

Mr. Forney.—With that amount of moisture in the steam it would seem to me that a steam separator would be an economical arrangement to use. The important point to establish is as to whether there is any considerable amount of moisture in the steam.

Mr. F. M. Whyte.—In calculating or estimating the economy resulting from the use of a separator, the gross economy must not be confused with the net economy; it is a very common error to confuse the two. The gross economy is based upon the amount of water and oil entrapped by the separator, and the net economy will allow for the drop in steam pressure due to the location of the separator in the steam passage. There are conditions under which a separator may produce a waste rather than a saving, and until reliable tests show otherwise, I shall think that the present design of locomotive fulfills such conditions.

Mr. Forney.—What is the ordinary drop?

Mr. F. M. Whyte.—In a well-designed separator it may be 2 or 3 lbs., whereas in another, with more tortuous passages, it may be 8 or 10 lbs. There are manufacturers, or their agents, who say that they will guarantee no drop in pressure, but it is best to ask for protection on such guarantees. The separator has a legitimate field, but we should use care not to expect too much of it.

American Society of Mechanical Engineers—Annual Meeting.

There was a large gathering at the first session of the twentieth annual meeting of the American Society of Mechanical Engineers, which was held in New York on Tuesday evening of this week. The annual address of the retiring President, Admiral George W. Melville, U. S. N., was on "Engineering in the United States Navy." He reviewed the work in the development of steam war vessels in this country, calling attention to many notable improvements, and referred at some length to the introduction of water tube boilers. Admiral Melville paid a high tribute to the ability of the young men who had served as engineers in the navy, and many of whom have taken high places in the engineering profession after leaving the navy.

The election of the following officers for the year 1899-1900 was announced Wednesday morning:

President: Mr. Chas. H. Morgan.

Vice-Presidents: Messrs. E. D. Meier, Geo. R. Stetson, B. H. Warren, Jesse M. Smith, Stevenson Taylor and David Townsend.

Managers: Messrs. Geo. Richmond, Jas. B. Stanwood, H. H. Suplee, E. C. Felton, A. M. Goodale, R. H. Soule, F. H. Boyer, Jno. A. Brashear and Alfred H. Raynal.

Treasurer: Mr. Wm. H. Wiley.

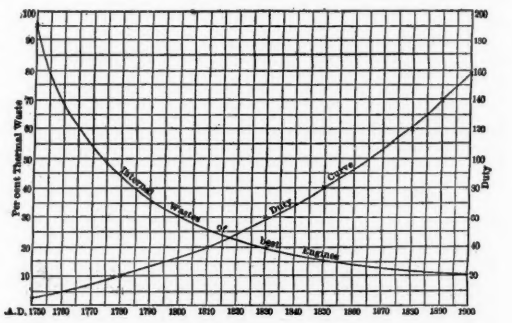
Secretary: Prof. F. R. Hutton.

Below are given abstracts of several of the papers. Others are given more at length as independent articles, or will be given in later issues.

The Steam Engine of the Nineteenth Century. By R. H. Thurston.

In this paper, Dr. Thurston gives a concise history of the development of the steam engine and shows how closely the results from recent trials of a steam pumping engine agree with those of the Carnot cycle. It is hardly possible at present to go into this question at length, but the following extract from the paper shows one of the important considerations in this historical sketch.

The wastes of our best engines may be to-day taken as usually not far from 20 per cent. thermal and 10 per cent. dynamic. At the beginning of the century they were, in Watt's best engines, about 60 per cent. thermal and 15 to 20 per cent. dynamic, as shown on the accompanying diagram. The progress of the century is seen to have been mainly in the reduction of the internal thermal wastes. The progress of to-day is mainly in improvement of the thermodynamic efficiency by increasing range of temperatures worked through, and by improving the cycle in the direction of approximation more nearly to Carnot's ideal. Its outcome at the end of the century is seen to be indicated by the duty curve, as probably a duty of about 160,000,000 foot-pounds per pound of pure carbon burned in the furnace of the best contemporary form of steam boiler; its efficiency being about 80 per cent. This diagram was constructed some years ago, and is therefore in the nature of a prophecy. It will be particularly interesting to observe, as time goes on, when and where the curve changes its curvature and assumes the ultimately inevitable concavity, indicating approach to the practical limit of gain by approximation to the ideal.



The Berthier Method of Coal Calorimetry. By C. V. Kerr.

Prof. Kerr's paper was suggested by the recommendation of the committee on the revision of the 1885 code at the Washington meeting, in which it was stated that the Mahler bomb calorimeter was the most perfect apparatus as yet devised for this work. The author of this paper presents some of the claims of the Berthier method of coal calorimetry, which uses oxide of lead (PbO) as the source of oxygen. His principal claim is that it requires only accurate weighing of the sample of fuel tested and there are not corrections for radiations and no delicate measurements of temperature to be made. On the other hand, there are sources of large errors in the use of oxygen gas. The theoretical corrections necessary are, however, readily made once for all, and as the errors due to handling this calorimeter are easily avoided, Prof. Kerr believes that the

method explained in this paper should be used more frequently. In regard to the cost of material for calorimeter tests by the Berthier method, the clay crucibles will cost about 4 cents each, and the charge of about 100 grams of litharge about 2½ cents. So that if five determinations are made for a given fuel, the total cost of material will be about 33 cents. A 4-in. Denvey clay crucible is large enough. It is well to use an excess of litharge, about 50 grams of PbO to one gram of coal, and to cover the mixture with about 25 grams of PbO.

Tests of Two Ten-Million-Gallon Pumping Engines at the Baden Pumping Station, St. Louis Water Works, June, 1899. By John A. Laird.

These tests are important because of the high mechanical efficiency obtained, which on test was found to be over 94 per cent.

The engines tested are duplicates built by the Edward P. Allis Company and are of the well-known type of Reynolds pumping engine. They are three cylinder triple expansion, condensing, vertical, with rigid connection between plungers and pistons, three single-acting plungers. The diameters of cylinders are respectively 30-in., 54-in., and 80-in. The plungers are 25½ in. in diameter, and all are 64-in. stroke. There are two receivers, the heating coils inside of which are helical and extend for the full length of the receivers. The cylinders are jacketed on the sides, but not on the heads. The jackets, cylinder heads, receivers, and all other heated surfaces about the engines are covered with 2 in. of magnesia and 2 in. of hair felt; the whole inclosed in walnut lagging.

The boiler plant for the station consists of eight 300 h. p. boilers of the water tube type. These have each 3,000 sq. ft. of heating surface and the upper grate of the furnace has 37.6 sq. ft. and the lower 50.3. The stack is 150 ft. high and 7 ft. internal diameter. The contract requirements were that each engine furnished under the contract should have a pumping capacity of 10,000,000 U. S. gallons in 24 hours at a speed which will insure smooth and quiet action and to be determined by the experts during the duty test. It was further agreed that the pumping engines furnished should perform during the running test of 24 hours, a duty of 125,000,000 foot-pounds per thousand lbs. of commercially dry steam. The contract also provides for a bonus to be paid in the ratio of $1,000 for each million foot-pounds the duty goes above 125,000,000, and a forfeiture of $2,500 for each million that goes below 125,000,000. A summary of these tests made on the two engines is as follows:

Engine Number.	7.	8.
Feed-water per I. H. P. per hour, lbs.	11.648	11.653
Dry steam per I. H. P. per hour, lbs.	11.627	11.632
Feed-water per D. H. P. per hour, lbs.	12.357	12.282
Dry steam per D. H. P. per hour, lbs.	12.335	12.258
Duty per 1,000 lbs. feed water (Contract), ft. lbs.	160,166,000.	161,240,000.
Duty per 1,000 lbs. dry steam, ft. lbs.	160,455,000.	161,530,000.
Duty per million British thermal units, ft. lbs.	143,404,000.	144,365,000.
British thermal units per I. H. P. per minute	216.84	216.51
Mechanical efficiency, per cent.	94.26	94.87
Thermodynamic efficiency, per cent.	18.44	18.59

A New Graphical Method of Constructing the Entropy Temperature Diagram of a Gas or Oil Engine from Its Indicator Card. By Henry T. Eddy.

Those interested in the temperature-entropy analysis will find in Prof. Eddy's paper an important addition to the published analyses of thermodynamic problems by this method. The analysis is from a practical standpoint, the cards used being taken from a Diesel oil engine test by Prof. Denton.

Compression and Liquefaction of Gases. By Arthur L. Rice.

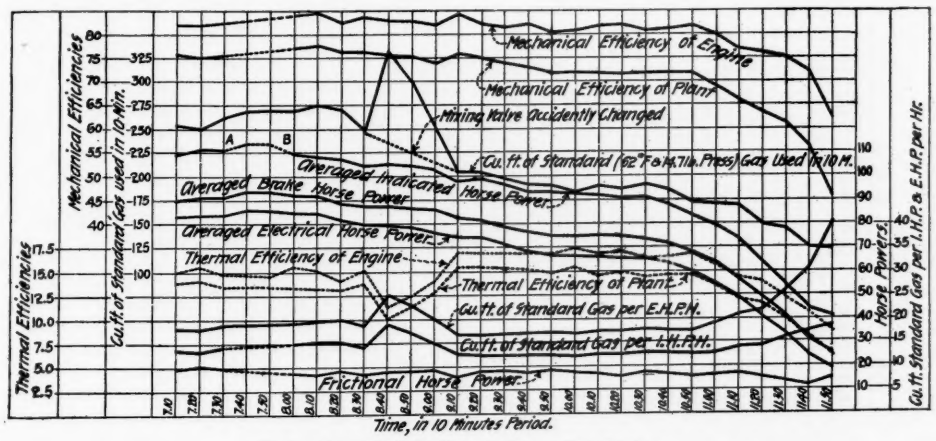
This paper was presented as one of the Junior meetings of the Society, a brief report of which was given in our issue of April 7, 1899, p. 251. Special reference is made in this paper to the production of liquid air.

A Curved Glass Blue Print Machine; and, a Metal Dynagraph. By Paul M. Chamberlain.

The former of these papers describes a new blue-print machine designed to catch the direct rays of the sun, to be worked easily and rapidly and to provide means whereby close contact may be had between the tracing and the sensitized paper. The other paper describes the machine for giving a definite test of the machinable qualities of cast iron specimens and at the same setting prepares the specimen for accurate tensile tests.

Experiments on Using Gasoline Gas for Boiler Heating. By Herman Poole.

This paper gives the results of experiments made at Philadelphia on a 60 h. p. boiler. The tests showed that "steam could be raised in a boiler with gasoline gas as a fuel, but as compared with coal it was much more costly." The tests were made with boilers fitted up with burners arranged especially for the trials and apparently not for every-day running conditions. We cannot regard the results of the tests as having much, if any, practical value.


Mechanical Efficiencies
Cu. ft. of Standard Gas used in 10 Min.
Horse Powers.
Cu. ft. Standard Gas per I.H.P. & E.H.P. per Hr.
Thermal Efficiencies
Mechanical Efficiency of Engine
Mechanical Efficiency of Plant
Mining Valve Accidently Changed
Cu. ft. of Standard (62° F & 14.7 lb. Press) Gas Used in 10 M.
Averaged Indicated Horse Power
Averaged Brake Horse Power
Averaged Electrical Horse Power
Thermal Efficiency of Engine
Thermal Efficiency of Plant
Cu. ft. of Standard Gas per E.H.P.H.
Cu. ft. of Standard Gas per I.H.P.H.
Frictional Horse Power
Time, in 10 Minutes Period.

Tests of a 125 H.P. Westinghouse Gas Engine.

Friction of Steam Packings. By Chas. Henry Benjamin.

During the past year, Mr. G. S. Beckwith, of the class of '99, of the Case School, made a large number of tests with different varieties of packing. The following brief description will show the general characteristics of each variety:

1. Square, ring, seven-eighths inch. Layers of canvas and rubber, saturated with graphite and oil.

2. Sectional, ring, seven-eighths inch. Composition similar to No. 1. Each ring consists of an inner and outer cone, fitting together, and so wedging under pressure as to fit tightly to rod and box.

3. Similar in shape and composition to No. 1.

4. Metal face packing. Alternate soft and metallic rings. The metallic rings contain lead band, backed by rubber and flax, the whole wound with cotton braid.

5. Two kinds; (a) a sleeve composed of woven flax, rubber, and canvas; (b) a spiral packing of woven flax backed with rubber.

6. Spiral, square, seven-eighths inch. Alternate layers of rubber and canvas.

7. Spiral, square, one-half inch. Layers of canvas and rubber, saturated with graphite and oil.

8. Similar to No. 7, but of a different make.

9. Spiral, square, one-half inch. Composed of rubber and asbestos compound, with elastic rubber inset. Slightly impregnated with graphite.

10. Spiral, circular, seven-eighths inch. Red rubber core, wound with layers of rubber and flax, and coated with graphite.

11. Spiral, round, half-inch. Two wedge-shaped strands of woven flax in centre, and two strands of canvas, the whole surrounded by a woven cover saturated with graphite and oil. There seemed to be also some paraffin present.

12. Spiral, round, half-inch. A rubber core, around which are braided three thicknesses of hemp or flax, soaked in oil. The whole coated with paraffin.

13. Spiral, round, one-half inch. A rubber core, surrounded with layers of woven cloth and rubber, impregnated with ground mica.

14. Square, one-half inch, pump packing. Alternate layers of canvas and rubber. No lubricant.

15. Square, one-half inch. Similar to preceding, but having a rubber back about one-eighth inch thick.

16. Square, one-half inch. Alternate layers of rubber and canvas. No lubricant.

17. Spiral, square, one-half inch. Woven flax, soaked in oil.

Table I. gives a summary of the results, showing the average horse-power consumed by each packing box at varying pressures sand, for purposes of comparison, the power at 50 lbs. pressure of steam . The friction of the machine has been deducted.

In most of the experiments detailed in Table I. the nuts were tightened with the fingers only, and then just enough to prevent leakage, and no lubricant was used except that incorporated in the packing itself. With some of the dry rubber packings it was necessary to use oil from the first. A good quality of cylinder oil was applied.

General Conclusions.—1. That the softer rubber and graphite packings, which are self-adjusting and self-lubricating, as in Nos. 2, 3, 7, 8, and 11, consume less power than the harder varieties. No. 17, the old braided flax style gave very good results. 2. That oiling the rod will reduce the friction with any packing. 3. That there is almost no limit to the loss caused by the injudicious use of the monkey-wrench. 4. That the power loss varies almost directly with the steam pressure in the harder varieties, while it is approximately constant with the softer kinds.

The diameter of rod used—two inches—would be appropriate for engines of from 50 to 100 horse-power. The piston speed was about 140 feet per minute in the experiments, and the horse-power varied from .039 to .400 at 50 pounds steam pressure, with a safe average for the softer class of packings of .07 horse-power.

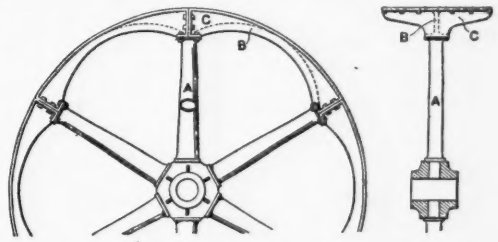
At a piston speed of 600 ft. per minute, the same friction would give a loss of from .154 to 1.71 with a working average of .30 h. p., at a mean steam pressure of 50 lbs.

Table I.

Kind of package.	No. of trials.	Total time of run in minutes.	Average h. p. consumed by each box.	H. p. consumed at 50 lbs. press	Remarks on leakage.
1	5	22	.091	.085	Moderate leakage.
2	8	40	.049	.048	Easily adjusted; slight leakage.
3	5	25	.037	.036	Considerable leakage.
4	5	25	.159	.176	Leaked badly.
5	5	25	.095	.084	Oiling necessary; leaked badly.
6	5	25	.368	.400	Moderate leakage.
7	5	25	.087	.067	Easily adjusted and no leakage.
8	5	25	.082	.082	Very satisfactory; slight leakage.
9	3	15	.200	.182	Moderate leakage.
10	3	..	.275		Excessive leakage.
11	5	25	.157	.172	Moderate leakage.
12	5	25	.266	.330	Moderate leakage.
13	5	25	.162	.230	No leakage; oiling necessary.
14	5	25	.176	.276	Moderate leakage; oiling necessary.
15	5	25	.233	.255	Difficult to adjust; no leakage.
16	5	25	.292	.210	Oiling necessary; no leakage.
17	5	25	.128	.084	No leakage.

A Note on Fly-Wheel Design. By A. J. Frith.

At a previous meeting it was remarked that a rim of a fly-wheel with shallow cross ribs meeting in a pad on the under side to which the arms were bolted had accidentally been run up to an unusual speed, after which it was found to be out of true, and on examination it was discovered that about 50 per cent. of the intersections of the arm pads and ribs on the rim were cracked around the entire wheel. Mr. Frith, in this paper, describes a method to prevent the cracking referred to. A sketch of his design is shown in the accompanying engraving. The important feature of this design lies in the proportioning part of the rim so that the arms will have an extra tension thrown upon them sufficient to bring the unit strains up to those of the rim sections.



The arms are to be made to withstand the strains which would be developed by the particular service the wheel is called upon to serve; that is, to drive the wheel, and to withstand the variation of speed without undue deflection. For this purpose the metal should be arranged in a section which gives the greatest rigidity with the least section, hollow arms and oval sections being particularly well adapted for the purpose. The weight of the total rim is figured to meet the condition of diameter, speed, and variation of speed desired.

It is believed that this method of reinforcing the rims of band fly-wheels in particular would obviate such accidents as that mentioned, and it has a particularly good feature in the depth of section immediately over the arms, where there should be no difficulty in providing a fastening of bolts whose total area would be sufficient to balance the total rim tension in the wheel, a condition which is so difficult to obtain under present conditions, although its necessity has been dwelt upon by everyone who has treated and discussed the subject before us.

Of this total weight of rim, part is circular as shown, and a part is arranged in arches between the arms, drawn to coincide with the natural catenary curve which the particles would take if free to arrange themselves to the forces induced. This curve is believed to be an ellipse, and is drawn to make an angle of 60 degrees with the arms.

To insure that the stress should follow the line of the several arches, and not pass directly and parallel to the outer rim, openings in the metal at C will probably be advisable.

It is believed that this method of reinforcing the rims of band fly-wheels in particular would obviate such accidents as that mentioned, and it has a particularly good feature in the depth of section immediately over the arms, where there should be no difficulty in providing a fastening of bolts whose total area would be sufficient to balance the total rim tension of the wheel, a condition which is so difficult to obtain under present conditions, although its necessity has been dwelt upon by everyone who has treated and discussed the subject before us.

An Efficiency Test of a 125 H. P. Gas Engine. By C. H. Robertson.

This test was made on the Westinghouse engine working at the Merchants' Electric Lighting Company's plant at Lafayette, Ind. The engine was similar in all particulars to the one described and illustrated in our issue of Sept. 15, 1899. The results of this test are given in the accompanying engrav-

ing, little or no explanation of which need be made. The conclusions from these tests warranted the following comparison:

1st, That the proportion of gas to air is a very important factor in fuel economy.

2d, That one test at a light and one test at a heavy load would serve to locate the line, from which a quite approximate prediction could be made of the gas consumption under intermediate loads.

3d, That these considerations hold for the fuel consumption per brake horse-power hour and per electrical horse-power hour.

The paper concludes with some miscellaneous notes on the running of gas engines of interest to gas enginemen. Among these are the following:

Chief among the changes expected to give greater economy in the engines tested will be the substitution of solid oil in the crank case instead of oil and water as at present. It is stated on good authority that the presence of water in the oil when exposed to the conditions met with in the cylinder, very much injures its lubricating effect, whence comes rapid wear of cylinders and bearings and, consequently, low mechanical efficiency. Care must be exercised in the amount of oil permitted in the crank case, lest so much reach the cylinders as to carry flame over an exhaust stroke and ignite the next succeeding charge and with it the mixture in the distribution pipe. Any considerable amount of this "back firing" has a very detrimental effect on the engine in general, and seriously interferes with good governing. Back firing may also be caused by a leaky admission valve or a leak in a caging on which the admission valve is seated.

Cases have been reported where engines are running on gasoline in which a coating of burnt oil has collected on the end of the piston. This, it is thought, may come to high enough a temperature to ignite the incoming charge. At any rate, the "back firing" ceased with its removal.

The red glow of exhaust pipe at night, or the red-hot condition of the copper ball used in determining the exhaust temperature, both convincing evidence of the high temperature within the cylinder. This high temperature gives some trouble with the exhaust valves, making it necessary to watch them quite closely lest a little leak soon burns out into a hole of considerable dimension. This intense heat sometimes has caused the breaking off of the exhaust-valve stem. The use of more metal in the valves has practically ended these troubles.

In a gas-engine plant the certainty of action depends on a number of details such as quality and time of ignition, proper compression, right proportion of gas to air, control of cylinder temperatures, etc. Any one of these defective to any considerable degree is quite sure to stop or prevent the starting of the engine. In one of the preliminary tests on this engine an observer accidentally struck one of the incandescent lamps in the igniting circuit. The lamp was apparently uninjured, but the engine at once slowed down. An examination of the lamp showed that just the tip end of the bulb had been broken off, thus destroying the vacuum within and, consequently, the igniting circuit.

On another occasion sand was deposited in the jacket from the cooling water, making it impossible to cool the cylinder properly. The result was that the heat of compression furnished a high enough temperature to ignite the charge, and the engine was run for some time without the igniters in operation.

At various times the gas supply for the city has been shut off. Under such circumstances the engine (acting as a pump) has continued to draw gas from the mains, and to run through such shut-offs of thirty minutes' duration.

Soon after the gasoline vapor generator was installed, artificial gas was piped to the plant, and proved so much more convenient for emergency runs that the vapor generator was not used, and at the present writing has been removed.

In the warm months of summer some trouble has been experienced in cooling the jacket water in the cooling tower. As a result, a motor and pump was installed at the river bank some distance away, and the jacket water secured from that source. As soon as the warm months were over the cooling tower was used again. When the engine was first installed, cast steel gears were used, which, on giving trouble, were replaced by steel cut gears. This change has ended the trouble from that source.

Natural gas is sold to the company by meter at the rate of 7 cents per thousand cubic feet.

Friction Tests of a Locomotive Slide Valve.*

During some recent locomotive tests made at the Rose Polytechnic Institute it was found desirable to operate one of the valves by means of an electric motor. It occurred to the writer that by making a few additional observations, some useful data upon the friction of a locomotive slide valve might be obtained. The changes made upon the locomotive to adapt it to the tests were as follows: The steam valve on one side was disconnected and blocked in the middle position, so that no steam could enter the cylinder on that side. The locomotive was moved on the track until the piston on the other side was approximately in the middle of its stroke, and then the main drivers were securely blocked. At the same time the cross-head was also blocked. The back-up eccentric rod was then disconnected, and an extension piece was bolted to the link for the purpose of connecting with an external source of power for driving the link motion and through it the valve. The power in this case was furnished by an electric railway motor of 15 h. p. On the end of the electric motor shaft was keyed a forged crank, with a 1 in. steel crank pin. The pin worked in a link block, which, in turn, slipped in a suitable slot cut in the extension piece to the main link. By this arrangement the forward eccentric-rod pin served as a fulcrum for the link, and a reciprocating motion was imparted to the link by the electric motor through the medium of the crank and slot. The link block of the locomotive mechanism was left in place, and imparted motion to the valve in the usual way. The movement of the valve could be regulated slightly by raising or lowering the link. Additional regulation of the amount of steam admitted to the cylinder was obtained by opening and closing the throttle. Indicators were connected both to the cylinder and to the steam chest, and the motion of the indicator drums was obtained directly from the valve stem, so that the length of the indicator card represents exactly the travel of the valve. The number of strokes of the valve was registered by a counter.

*Extracts from a paper, before the December meeting of the American Society of Mechanical Engineers, by Prof. F. G. Wagner.

The power used to drive the valve was obtained by measuring the electrical power delivered to the electric motor, and making suitable allowances for the efficiency of the motor and the friction of the transmitting mechanism. This was done as follows: After the tests were completed, the valve stem was disconnected and the electrical power required to drive the electric motor and transmitting mechanism was determined for various speeds. The efficiency of the electric motor under various loads had previously been determined in the laboratory. By comparing the efficiencies at the two loads, the increased loss of power in the electric motor when driving the valve over and above the lost power when the valve was disconnected, was determined and allowed for. No allowance was made for increased friction of the link-work. The crank pin and sliding block, used to transmit the power from the motor shaft to the link, were flooded with oil by dipping into a bath of oil and water with every revolution of the motor. The friction of other portions of the link-work and of the rocker arm was relatively small, and no great error can be introduced by considering it to be the same for the different loads at the same speed.

The dimensions of the valve experimented upon, and the results obtained, are given in Tables I. and II.

Table I.—Dimensions of Valve.

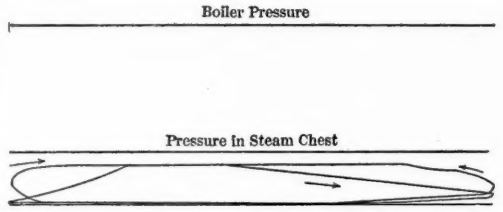
Type of valve	D slide
Width of valve	9.25 in.
Length of valve	17 in.
Width of port opening	1.25 in.
Length of port opening	15 in.
Width of exhaust port	2.50 in.
Width of bridge	1.25 in.
Steam lap	0.875 in.
Exhaust lap	0.125 in.
Gross area of valve	157.25 sq. in.
Balanced area of valve	54.5 sq. in.
Unbalanced area of valve	102.75 sq. in.
Total bearing area of packing strips	22.20 sq. in.
Gross rubbing surface, bottom of valve	86 sq. in.
Average net rubbing surface, bottom of valve, for 3-in. stroke	58.20 sq. in.
Rubbing surface, top of valve	22.20 sq. in.

Table II.—Friction of Valve.

Number of test	1.	2.
Duration of test, hours	2.25	0.62
Number of observations	10.	3.
Double strokes of valve per minute	421.	410.
Speed of valve, feet per minute	210.5	205.
Average steam pressure in boiler, pounds per square inch	144.9	154.
Average steam pressure in steam chest, pounds per square inch	42.18	122.0
Downward force on valve due to pressure in steam chest, pounds	4,334.	12,534.
Average upward force on valve due to pressure in steam cylinder, pounds	373.	596.
Net force pressing valve upon its seat, pounds	3,961.	11,938.
Intensity of pressure between rubbing surfaces, face of valve, pounds per square inch	68.	205.1
Intensity of pressure between rubbing surfaces, pacing strips, pounds per square inch	42.18	122.0
Average power delivered to electric motor during test, horse-powers	4.85	7.45
Power consumed in driving motor and link-work, horse-powers	3.30	4.14
Net power consumed in driving valve, horse-powers	1.55	3.31
Average force required to move valve, pounds	243.	533.
Drops of oil fed to valve per minute	20.	15.
Coefficient of friction	.050	.036

The average net rubbing surface on the bottom of the valve was found by subtracting from the total rubbing surface, on the face of the valve, the average amount of such surface which was over the ports during one stroke of the valve. In calculating the force with which the valve is pressed upon its seat, allowance has been made for the upward pressure on the portions of the valve which extend over the steam ports. Both the area thus acted upon and the pressure vary during the stroke; it is not difficult, however, to obtain a sufficiently accurate average value for both quantities. The oil used to lubricate the valve was a high grade cylinder oil such as is regularly supplied by the Vandalia Co. for use on its locomotives.

In the accompanying figures are shown sample indicator diagrams from the steam cylinder for each of the tests. Additional lines have been placed upon the diagrams, to show the average boiler pressure and the average pressure in the steam chest during the tests. The indicator diagram taken from the steam chest was substantially a straight line, showing that with the valve speeds used, a constant pressure was maintained in the steam chest. One interesting point disclosed by the indicator diagrams, is the time required for the opening or closing of the ports to make itself felt upon the pressure in the cylinder. The distance on the indicator diagram between closing to steam, and opening to exhaust, should be equal to the sum of the steam and exhaust laps, that is, 1 in. The distances upon the diagrams vary from 1⅛ to 1⅝ in., showing an appreciable lag between the actual closing and opening of the ports and the corresponding points on the indicator diagram. It is to be kept in mind, however, that these indicator diagrams correspond with the motion of the valve, and not, as in the ordinary diagram, with the motion of the engine piston, and also that the piston remained stationary at the middle of its stroke.



Friction Tests of Locomotive Slide Valve.

Railroad Statistics to June 30, 1899.

The Statistician of the Interstate Commerce Commission has issued a Preliminary Report on the Income Account of railroads in the United States for the year ending June 30, 1899, compiled from the returns of companies representing 185,256 miles of line. Gross earnings were $1,307,253,484, or $7,057 per mile, divided as follows: Passenger, $360,227,319; freight, $913,358,488; miscellaneous, $33,667,677. The gross earnings shown in the final report for 1898 were nearly sixty million dollars less than this amount. Operating expenses were $852,428,105, or $4,602 per mile of line; net earnings from operation were $454,825,379, an increase of $31,073,304. Income from sources other than operation amounted to $49,176,168. A large portion of this was received as interest on railroad bonds and dividends on railroad stocks owned, and it is therefore largely offset in the aggregate deductions from income given below.

The report shows that the total income of the operating companies included was $504,001,547. The total deductions from income (interest on funded debt, rents for leased lines, $44,165,714 in taxes and various other charges against income, but not including dividends) were $371,018,518. This amount is $11,327,847 greater than the corresponding figures from the complete statistical report for 1898. The aggregate amount of dividends declared by the operating railroads under consideration was $82,214,820; previous year, $66,039,463. The surplus from the operations was $50,768,209 on about 98 per cent. of the mileage in the United States. The corresponding preliminary report for the previous year, covering 181,333 miles of line, showed a surplus of $42,604,999.

The present report, being restricted to the income accounts of operating roads, does not include the fixed charges and dividends of subsidiary roads operated under lease, since the income from which they are paid is derived from the rents included in the charges against the income of the operating roads.

Photo Printing.*

By Herman Esser.

General.—There are at present three different processes in actual use for copying drawings by the aid of the sunlight. The so-called blue or negative process, giving white lines on a blue background; the nigrosine or positive black process, giving neat black lines on a white ground; the umbra process, a variety of the nigrosine, and the maduro or brown process, being also a negative process, and giving white lines on a dark brown ground.

All other processes for the purpose of copying drawings by the aid of the sunlight are either too cumbersome in their manipulation, or need dark rooms and other appliances, so that they cannot come into general use with architects, engineers and

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draftsmen. Although the processes mentioned above are well known it will not be superfluous to give some general information and hints which may be of interest and value even to those who are familiar with one or more of them.

Papers.—For the nigrosine, umbra and maduro processes special papers only can be used, which must have certain qualities known only to the makers of these papers. These papers are as perfect for the purpose intended as they can be made, and differ only in thickness or weight. For the blue process, also, special papers are made, which embody all the necessary requirements for this process, and insure permanent prints of brilliant blue color, with clear white lines. Their keeping qualities in a prepared state are such as can be expected from a paper prepared with chemicals, and they remain strong and tough in the water bath. However, the blue process not being so delicate as the other processes, is practicable on inferior papers, which naturally show defects, but which are used to quite an extent on account of their cheapness. But good and lasting results can only be expected from good and serviceable papers, which cannot be made at the selling price of inferior grades.

The prepared papers for any sun printing process must be kept in a dry place, as moisture is very injurious to them. They must be kept away from heat and from daylight. The best way of keeping and preserving photo papers is in a tightly closed tin tube, and when this is not at hand the paper should always be kept rolled up tightly in its original wrapper and placed in a drawer.

Tracings.—The drawings to be copied by any of the sun printing processes should be made on the most translucent material, either tracing cloth or tracing paper, the latter not of a yellowish hue, but preferably clear white, or of a bluish tint. The drawing ink to be used must be perfectly black and opaque, so that no trace of light can penetrate through the lines. If the lines are not sharp and opaque, blurred and indistinct lines of the sun copy will be the necessary result. Red and yellow lines will only show very faint on the copy, and blue lines will not appear at all, as the blue offers little resistance to the chemical rays. The original to be copied should also be smooth, and without creases, as these would show on the copy.

Printing Frames.—For printing, print-frames should be made of well-seasoned hard wood which will not warp, even when exposed to a slight rain or other moisture. Many a glass is broken through the warping of the frame, and cheap frames are consequently dear at any price. The frame should be provided with a clear and strong glass, preferably polished plate glass, which stands the necessary pressure better than a glass not ground and polished. The breaking of the glass in a frame containing an original drawing has often caused a loss much greater than the difference in the prices of a common and a good glass. For frames having a printing surface of more than four square feet only a plate glass should be used.

The printing frame should also be provided with a well made back, hinged together and pressed down by battens to which good and strong springs are attached. The hinged back-board is used so that a part of the exposed paper may be examined without disturbing the rest; the strong springs are necessary to insure an even contact over the entire surface of the glass, drawing, and prepared paper. Irregular contact will result in blurred and indistinct lines, which are often erroneously attributed to the paper. A soft pad or cushion completes the printing frame. Its object is to press the paper to the drawing and glass, and relieve the latter of undue pressure. The pad should be white, as this color quickens the printing process.

Printing.—Place the printing frame face down and remove the back and pad. See that the glass is clean and perfectly free from dust or other matter. Put the tracing in first, with the side drawn upon next to the blass, place the prepared paper with the coated side on the tracing paper, cover with the pad, and see that everything lies smooth and in proper position; replace the back and close it by means of the battens with springs; turn the frame over, see that the glass is also clean on its face, and expose to the sun. This entire manipulation has, of course, to be done in subdued light, as otherwise the prepared paper would be affected. It is always very desirable, and with the nigrosine and maduro processes absolutely necessary, to cut the prepared paper a little larger than the original to be copied, in order to observe on the protruding margin the action of the light upon the sensitized paper.

After the exposure is completed, the copy is taken from the frame and developed according to the process, as described below:

Blue Process Paper.—The prepared paper for this process is of a light greenish yellow tint when freshly coated. In the course of time, however, and particularly during the summer months, the paper turns to a darker tint up to a blue-gray, which, however, is no indication that the paper is spoiled and unfit for use.

Good prepared paper for this process will keep unimpaired at least three months. The Helios papers have been for many years generally recognized as the best for photographic and other fine work. Both their printing and keeping qualities are superior to other blue print papers. Where price is more of an object than quality, the Columbia papers are generally preferred, as being the best value for the money. Cheaper papers can be bought, but they are not economical. The difference in price is small and not enough to compensate for inferior results, to say nothing of the waste of time and paper through the tearing of wet prints. When extra toughness is wanted, the Parchmine papers are used, unless light weight is also a consideration; in that case the E. T. (extra thin) papers are recommended.

Blue process papers cannot be judged by their color; only an actual test will show whether the paper is perfect or not. The exposure of blue process paper takes from four to eight minutes in bright sunlight, varying, of course, with the intensity of the light and the transparency of the material upon which the tracing is made. In the shade, or on dark and foggy days, the exposure may last up to one hour before it is completed, and on such days judgment must be used in determining its duration, and good care taken that the paper is not taken from the frame before it has been sufficiently exposed. When the margin protruding from under the original drawing has attained a greenish-bronze color, open one part of the back of the frame and observe the copy. If the lines stand out sharp and distinct on a gray background, the exposure is completed. Then take the copy from the frame and place it in a bath tray containing sufficient water to fully cover the print. Here the lines will gradually turn into white while the background is changed into brilliant blue. Rinsing the print by means of a spray will quicken the washing. As soon as the lines stand out in clear white the print may be taken from the bath and hung up to dry, which completes the work. Remember that the fresher the paper is the slower it will print and the quicker it will wash out; the older the paper is the quicker it will print but the slower it will wash. To obtain satisfactory results never take prints from the water bath before the lines are perfectly white, although it may take hours to effect this. As soon as the bath becomes discolored, renew by fresh water, as otherwise the chemicals dissolved in the water will discolor the white lines to a bluish hue. The longer the exposure the darker the blue ground of the paper will be, but the lines of the drawing should always appear in a clear white color, provided the original shows opaque lines. The copies after drying will be darker than when they are taken from the bath. Papers printed in direct bright sunlight will generally not produce such a rich and beautiful blue background as those which are exposed in the shade.

Quick Printing Blue Process Paper.—These papers are coated with a solution which is affected in considerably less time than those with which the regular papers are prepared. Consequently the exposure of this "quick paper" is materially shorter and is completed in from 1½ to 2 minutes in bright sunlight. They are a great advantage on dark days, particularly in winter, when days are short, and the rays of the sun are less intense. The sensitiveness of this paper, therefore, makes it especially necessary to be careful in keeping it from light and moisture, and also in handling and manipulating it. The printing, washing and drying is exactly the same as explained above and just as perfect copies are produced with no more trouble than with the regular papers. It must, however, be said that "quickprint" papers have not the same lasting qualities as the regular papers, that heat has more effect on them, and that therefore they spoil easier and quicker during the summer months.

Nigrosine Paper.—This is a positive paper, giving a fac simile of the original drawing, in clear black lines on a white ground. It overcomes the great objection to blueprints of shaded drawings which show light and shade reversed. Nigrosine prints can be colored, shaded, altered, etc., just as an original drawing. The nigrosine paper is of a reddish yellow color which turns to white in sunlight. The paper with the original to be copied is placed in the printing frame exactly the same as blue process paper. When the protruding margin has turned white, which takes from 3 to 5 minutes in sunlight, the exposure must be carefully watched. As soon as no difference in color can be observed in comparing the margin with the paper that was not covered by the original, the exposure is completed and the copy will show reddish yellow lines on white background. The copy is then immersed in the developing bath, prepared according to directions accompanying the developer, and left there for one or two minutes until all of the lines have turned to a grayish black color. After this the copy is placed in a clear water bath, rinsed off on both sides by means of a spray and left in the water bath for about one-half hour, when it is hung up and dried. If copies are taken too soon from the water bath, heavy lines are apt to run, which, however, can be prevented by drying the prints off with blotting paper before hanging up to dry.

Faint lines on white ground are an indication that the exposure was too long, whereas sharp and distinct black lines on a dirty blueish gray ground indicate that the exposure was too short.

Umbra Paper.—The umbra paper is essentially the same as the nigrosine paper except that no developing bath is necessary, as the developer has been added to the sensitive coating. It is handled and exposed like nigrosine paper, takes from 4 to 6 minutes to complete the exposure, and is immersed in the water bath only, where it remains until all the lines are sharp and distinct. After this it is manipulated exactly like nigrosine paper. Proper care has to be taken with umbra paper, particularly in summer, as the smallest amount of moisture (perspiration of the fingers, etc.) on the unexposed paper will produce black spots.

Photographers will observe that nigrosine and umbra are positive processes and give a negative print from a photographic negative.

Maduro Paper.—This is the quickest and in many respects the most satisfactory sun copying process so far in existence. After exposure for about two minutes in bright sunlight, the margin protruding under the tracing turns from its original light yellow color to a reddish brown. The copies are then taken from the frame, immersed in the water bath, and thoroughly rinsed on both sides by means of a spray, when the ground will immediately change to a sepia brown color, the lines coming out in perfect white; or the prints may be left for 15 to 20 minutes in running water with the same results, but spraying off for a few minutes is preferable. They are then immersed in fixing solution made from the salt, which accompanies each roll of maduro paper, taking 2 oz. of the fixing salt to one gallon of water. The fixing solution may otherwise be applied with a wide brush; this will make the prints not only permanent but will turn the sepia brown color to nearly black, while the lines become white. After this the prints must be thoroughly washed for 20 to 30 minutes and then hung up to dry.

The brown color of the maduro prints being impervious to light makes this paper very valuable for making negatives which may be used to produce positive copies either with the blue or maduro process. For this purpose a very thin but strong paper is used.

The manipulations are the same as explained before, with the exception that the original to be copied is placed with its back to the glass in the frame, the side drawn upon being in direct contact with the prepared side of the maduro paper. After exposing and finishing the result will be a reversed copy, white on brown ground, of the original. If now this reversed copy is used as a tracing, exposing it again in the manner described above, with a sheet or maduro or blue process paper it will yield an exact reproduction of the original in either brown or blue lines on a white background. The time of exposure will naturally be somewhat longer, as the maduro paper, no matter how thin it is, will never be as transparent as tracing cloth or tracing paper. The distinctness and sharpness of even the finest lines are astonishing, but are due to the fact that in both manipulations the original was in direct contact with the sensitive paper so that no light could reach sideways under the lines. It is very essential that the first copy, when it is to be used as a negative, should lie perfectly flat and without wrinkles.

Electric Railroads and Magnetic Disturbances.

In our issue of Oct. 21, 1898, we called attention to the effect of powerful electric currents near magnetic observatories on the sensitive instruments at these stations. In England this question has once more come up and this time resulted in the appointment of a committee composed of three representatives of the laboratories, four of the electric railroad companies and one for the Board of Trade, who will investigate the matter and report later.

Every effort has been made to prevent leakage of the current from electric railroads. The Board of Trade Traction Regulations (which are considered in some quarters to have retarded development because of their very stringent requirements) aimed especially to reduce the leakage to a minimum, and it is certain that on the lines which have been working for some years there is little cause for complaint. But even the closest compliance with these regulations is not considered to meet the case of magnetic observatories, whose officials protest that the existence of trolley or conduit lines using the rails as the path for the return current, in proximity to their observatories, causes the most serious effects to their delicate magnetic instruments.

It may perhaps be remembered that a year or so ago a London tramway company set on foot a scheme for many miles of trolley line, but the opposition by some leading scientists was so great as to render practically certain the rejection of the proposal. The Directors of the line, therefore, considered discretion the better part of valor, and approached their opponents with an offer to use a double trolley system instead of using the rails for the return current. This met the opposition's views and there was no difficulty in securing the necessary powers. The constructors have now got their work well under way. The track is mostly double throughout, and this therefore necessitates four overhead conductors, and adding to this the requisite guard wires used in English practice, it will be seen that absolute necessity alone brought about the adoption of the double trolley.

The Hungarians are preparing to supply Constantinople with milk, in spite of the distance, which is about equal to that from Chicago to Baltimore. The milk is to be frozen by a process invented in Sweden, enclosed in cans holding about 60 gallons each, enclosed in a felt packing, and shipped in ordinary freight cars. As a test the Hungarians ordered some milk sent them from Sweden. It was shipped June 25 and arrived July 2 in perfect condition.

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to improvements. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

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Friction of Locomotive Slide Valves.

Prof. F. C. Wagner's paper, before the American Society of Mechanical Engineers, on the friction of locomotive slide valves, is given practically in full in this issue, and is interesting on account of the novel method of conducting the experiments. The results, however, can hardly be compared with those obtained by other investigators without knowing a good deal more about their tests than has been reported; with the information at hand allowances cannot be made for differences in conditions.

In 1896 a committee of the Master Mechanics' Association reported the results of slide valve experiments at the locomotive plant of Purdue University, and while many tests were made, the power required to move the valve was expressed as a per cent. of the total power developed in the one cylinder, a plan well adapted to those particular experiments, but not well suited for comparison with other tests. The committee also considered that the accuracy of its measuring apparatus was so doubtful that the several tests were thought to be only comparable one with another. The main conclusion was that the unbalanced valves required about twice as much work to move them as the balanced valves.

In this there is agreement with another notable series of tests made by Mr. J. A. F. Aspinall with locomotives on the Lancashire & Yorkshire and reported to the Institution of Civil Engineers in two papers, one in 1889 and one in 1898. In the latter set of experiments the speeds varied between 6 and 18 miles an hour, the boiler pressure averaged about 150 lbs., the throttle was wide open and oil was fed through a sight-feed lubricator at the rate of four drops a minute. The force required to move the valve was recorded by an oil dynamometer placed in the valve rod and two kinds of valves were tried. One was an ordinary D valve of phosphor-bronze and the other was of cast iron of the Richardson balanced type, sliding against a cast iron plate. The valves measured 10¾ by 15 in., but the paper does not give the balanced area. In the partially balanced valve, the balanced area was taken as that portion which was enclosed between the strips, excluding the area of the strips themselves. The average results from 31 sets of diagrams taken with the phosphor-bronze valve showed that a force of 1,946 lbs. was needed to overcome the friction, and that the average coefficient of friction was 8.78 per cent.; the corresponding figures for the balanced valve, averages of six diagrams, were 854 lbs. and 9.19 per cent., respectively.

Reference to Prof. Wagner's tests will show that at very much higher speeds, over 400 complete strokes a minute, the average force required to move the valve was 243 lbs. and 533 lbs., depending upon the steam chest pressure, while the corresponding coefficients of friction were 5 per cent. and 3.6 per cent. It may be noted that the results of the Master Mechanics' Association tests show a marked reduction in the mean force required to move the unbalanced valve as the speed is increased, the steam chest pressure remaining constant, but this does not seem to hold for the balanced valves tested, and it can scarcely be offered as an explanation of Prof. Wagner's low results, although true of the coefficient of friction of dry metal surfaces. While possibly having no bearing, attention is also called to the decrease in the coefficient for the higher steam chest pressure, something that is true for dry metal surfaces. But what would tend to affect the results as shown was the amount of oil used; this was 4 drops a minute in the English tests and from 15 to 20 for those of Prof. Wagner. Mr. Aspinall notes in his paper that with an increased number of drops of oil there was a perceptible improvement in the action of the valve. The difference might also be accounted for by a larger balanced area in the valve of the American engine, but, as previously stated, data are lacking for such a comparison.

Yellow Signal Lights.

The character of the discussion at the Boston meeting of the Railway Signaling Club, on yellow glass in signal lights, seems to justify a restatement of the present standing of the problem which the New York, New Haven & Hartford has grappled with, and, we suppose, so far as its own needs are concerned, has settled, but which nearly everybody else is extremely cautious in handling. Our report of the discussion was made very brief for what seemed good reasons, but it must not be inferred from this brevity that the members of the club were brief in their expressions or that their thoughts on the subject are meagre. They kept up their questions for an hour or more, and scarcely a person present omitted to give his views, or to draw out some one else's.

We shall try to state the considerations, pro and con, as we understand them to have been taken up by the New Haven people; though we do not mean by this that we shall consider the subject solely from the New Haven's standpoint; we shall discuss it without regard to locality.

1. Why make any change at all? 2. A change being desirable, is a single third color desirable, and can it be found? 3. These points settled, is it certain that yellow is the best color? 4. What has been sacrificed in adopting yellow?

1. On the first point the New Haven road's situation was simple. Two passenger train accidents had happened in consequence of the use of white lights for all-clear. The obvious remedy was to use green in place of white; and this at once left the distant signal unprovided for. The significant fact now before the railroad officers of America is that the desirability, or the necessity, of using green for all-clear is coming to be generally recognized. Cities are growing so fast, street lights are becoming so common, and fixed signals are so numerous that the superintendent or signal engineer does not need a collision to convince him that as long as "white" is a signal color, even a vigilant engineman stands some chance of being deceived by a false light.

We may remark in passing that discussion of a third color does not involve the question of color-blindness. The use of red and green for opposite indications, in a home signal, presupposes normal color vision in the enginemen and firemen, and the question of excluding color-blind men from the service should no longer be regarded as debatable under any circumstances.

2. A third color is desirable on general principles, and the point needs no argument. The Boston & Albany has for 15 years used form signals at night, providing three lamps for each semaphore (except in low-speed signals); but the entire lack of imitators, and the satisfaction found everywhere in the use of single lights would seem to indicate that the question of cost is alone an important point in favor of single lights. Mr. Rhea estimates the minimum cost of each signal lamp at $12 a year, not counting repairs. The Chicago & North-Western uses two lights in distant signals, but keeps the cost down by illuminating both lenses from a single lamp, by means of a mirror. We understand this distant signal to be satisfactory, but we cannot imagine that the C. & N. W. people would oppose the general use of a single light if it be proved safe and convenient. That a third color could be found was prima facie probable from the fact that blue lights have long been used as "back lights;" also that yellow has been used in France. Hardly any one but would undertake the task of getting up a blue, yellow or purple light if those who wanted it would provide money enough.

3. The New Haven people appear to be satisfied that yellow is the only practicable third color for night signal indications; and they make out a strong case. Everybody admits that a glass with much blue in it is practically black, for signaling purposes; and a glass with only a little blue in it cannot be made to appear blue at any considerable distance, except by a powerful light (like an arc lamp), and a large surface of glass; conditions not easy to provide in signaling. With blue thrown aside (which disposes of purple also), yellow is the only color left. The only question with yellow is, is it really a third color? All our common so-called "white" lights are really yellow; how can we differentiate from that? To put in more color gives a reddish appearance. At a distance, and in a smoky atmosphere, a "white" will appear yellow, or even reddish, and with a yellow glass the light will be still more reddish. If the red signal lights of a road are poor quality, they may, under some conditions, appear about the same as lights with thick yellow glass.

The answer of the New Haven management to these ifs, which is the same that we have ourselves given for years, is, they are not so vital as to demand an immediate answer. The Metropolitan Elevated of Chicago successfully uses common "white" lights for distant signals. The experience of that road is, indeed, limited, and the speed of its trains is not high; but it is to be remembered that signal engineers of ability have approved the theory of the use of "white" for distant lights, and that this Chicago practice tends to justify the theory. It affords strong presumptive refutation of the claim that a yellow light which is too pale, will not fulfill its function. The objection in the opposite direction, that a yellow which is not pale will look like red, is met by the practice of the English. Their distant signals not only look like red, they are red; and we hear of no difficulty. The practice is universal, and of long standing, and no trouble is experienced. The reputation of the English railroads for safety is the highest in the world.

4. The main thing that has been sacrificed is a theory; the theory that every signal light must be thoroughly and radically distinctive under all circumstances, and that enginemen must never pass a light which gives even a suggestion of red. Now, how much of a loss have we sustained? What and how many collisions or derailments have occurred in consequence of allowing red signals to be fixed in positions where enginemen must sometimes pass near them? We do not recall an instance. At most junctions and large yards enginemen are obliged every night to run very close to signals which show red but which do not govern the track on which the engineman is traveling. This being so, we can never think of telling the engineman that he must stop every time that he sees a red light; and if once it be granted that enginemen must select the red lights which they are to obey, the opponents of this ideal theory have pretty nearly won their case.

We have no doubt that there are Englishmen who, as a matter of theory, will agree that it is desirable never to use a red light except for a signal which means stop at the light; but in practice they all sacrifice the theory, and in place of it depend on the other theory—which they make a practical principle—that enginemen shall know perfectly the location and situation of every signal light; so that the question whether a given signal is a home or a distant can always be readily decided without considering the question of color. This theory is recognized everywhere; but practice on our prairie roads seems to have given rise to the fear that it is possible to depend on it too exclusively. If there is a basis for this fear, our English cousins would meet it, no doubt, by advocating the use of artificial landmarks, where necessary, to aid enginemen in quickly finding out the location of a signal.

But without spinning theories too far, why not appeal at once to experience? The New Haven road has now used the yellow lights six months on its hundreds of signals, and, we understand, without any trouble whatever. The advantage of having green in the place of white for all-clear is so well appreciated by both officers and enginemen that all hands are at the outset disposed favorably toward the change. Possibly this may lead some of the men to give insufficient weight to considerations which are unfavorable to the yellow, but we have not discerned any indications of this. We have no doubt that some of the enginemen at some of the signals have at times considered the lights very reddish;

but even so, the conditions are better than on the railroads of England. With the experience of England and New England in practical accord, what more is there to be said? We have the 25 years' test in England to assure us of safety; and by making the glass yellow we save the theory in fairly good condition.

The people of Worcester, Mass., are reported to be rejoicing at the prospect of a lease of the Boston & Albany to the New York Central, because they believe that by the time this "wealthy foreign corporation" has taken control in Massachusetts, the legislature will change the grade-crossing law so that the city will have to pay, for the costly changes of grade that must be made there, not ten per cent., as under the plan now prevailing throughout the State, but 0 per cent.—nothing at all. In any other State in the Union cities are usually extremely glad to get their crossings abolished by paying 10 per cent. of the whole cost, but in Worcester the people—at least some of them—seem to think that their present wish is very modest and reasonable. On general principles Worcester would rather not see the New York Central in Massachusetts, but just now the crossing problem overshadows everything else. The State's appropriation of $5,000,000, to ease the burdens of the towns, was first available 10 years ago, but at Worcester the physical difficulties were so great that the city could not decide what it wanted, and got the legislature to specially exempt it from the operation of the law, until April, 1900; and, although expensive surveys and estimates have been made, and public meetings have been held, the problem seems to be no nearer settlement than it was six years ago. The $5,000,000 from the State will be used up in a few years (the fund could be exhausted by other towns and cities within one year if a sufficient number of them should agree with the railroads and put in their applications). It is by no means certain, however, that the State's policy will be changed. The legislature will doubtless be asked to make another appropriation of $500,000 (maximum) yearly for ten years; and, as no serious opposition has been made to the existing law, it seems not unlikely that the advocates of continuing the present liberal policy of the State may be in the majority. The supposition that the legislature will be less friendly to a foreign corporation than to companies belonging in Massachusetts is, of course, pure conjecture, for the legislature has not yet met and it does not appear that any canvass has been made of the members' views. As the New York Central has promised to use all the profits on the Boston & Albany for the benefit of the road itself, and of its patrons, it is difficult to see why the State needs to be any more grasping in the future than it has been in the past.

Word came from London last week that the torpedo boat destroyer Viper, which is driven by Parsons steam turbines, has run at the rate of 37 knots (42.55 miles) an hour in a rough sea. This, we take it, is not official, but is probably correct. This speed is two knots more than the speed contracted for. The Viper is a vessel of 325 tons and her engines can develop between 10,000 and 12,000 h. p. She was built by the Parsons Steam Turbine Co., of Wallsend, and is the first war vessel to be fitted with steam turbines. It is important that Mr. Parsons has been able to develop a steam turbine which gives results thus far not secured from the direct acting engine. It is also worthy of note that he applied his invention to a branch of engineering which had been in existence for nearly a century and for which the turbine seemed most unfit, and the running of such a piece of machinery at thousands of revolutions a minute seemed only a few years ago like the proposal of a visionary man. Mr. Parsons not only made the suggestion but overcame the many difficulties, broke many of the accepted rules of marine engineering and produced a boat, the Turbinia, which was the fastest vessel in the world until the record was broken by the Viper.

The value of a Y on which to turn passenger trains is well illustrated by the practice of the Peoria & Pekin Union Railway at Peoria, Ill., where every day 12 or 15 trains are turned without any uncoupling. The trains of a number of different roads come into the terminal of this company at Peoria and the various requirements of combination cars, of sleeping cars which it is desired to run with the heater constantly at the front end, and of certain day cars, were found to necessitate so much turning that the time spent at the turn-table took up a considerable portion of the energies of the switching crews every day. It was finally determined to use the Y, and although it is two miles from the passenger station, the expedient has been found satisfactory. A yard engine makes four trips a day, taking three or four short trains each trip. Formerly from 15 to 25 minutes was usually taken up in turning one car. Now 12 to 15 cars are turned in 30 minutes. Some of these trains are also turned at the other end of their run, so that the couplings may be run for weeks without suffering from the wear and tear of being opened and closed; and the attendant liability to damage from shocks is practically done away with.

The Railroads of Japan.

The Annual Report of the Imperial Railroad Bureau for the fiscal year ending March 31, 1899, shows that the addition made during the year to the mileage of the lines open for traffic was 471 miles and 60 chains. The entire mileage, on state and private lines, open for traffic at the end of the year under review was 3,420 miles and 50 chains, and adding thereto the lines under construction and those for which charter had been given, the total stood at 5,810 miles. The following table will show progress made in the past twenty-seven years:

Mileage at End of Fiscal Years.

Fiscal Year.	State Lines. miles.	Private Lines. miles.	Total miles.
1898-9	768	2,652	3,420
1897-8	661	2,287	2,948
1896-7	631	1,875	2,507
1895-6	593	1,697	2,290
1894-5	580	1,537	2,118
1893-4	557	1,381	1,938
1892-3	550	1,320	1,870
1891-2	550	1,165	1,716
1890-1	550	848	1,399
1889-0	550	585	1,136
1888-9	505	406	912
1887-8	300	293	593
1886-7	264	165	430
1885-6	223	134	358
1884-5	181	80	262
1883-4	181	63	244
1882-3	170	....	170
1881-2	122	....	122
1880-1	98	....	98
1879-0	73	....	73
1878-9	65	....	65
1877-8	65	....	65
1876-7	65	....	65
1875-6	38	....	38
1874-5	38	....	38
1873-4	18	....	18
1872-3	18	....	18

The total rolling stock on the State and private lines at the end of the year under review comprised 1,103 locomotive engines, 3,811 passenger cars, and 14,088 freight cars. Compared with the corresponding date of the previous year, there was an increase of 209 locomotive engines, 911 passenger cars, and 2,663 freight cars. There were for every 100 miles 32 locomotive engines, 112 passenger and 413 freight cars. The above mentioned total of the passenger cars includes three Imperial carriages and 582 accessory cars such as the brake vans, luggage and postal cars. Excluding these, the remaining passenger cars had a total capacity sufficient to accommodate 5,657 first-class, 15,660 second-class, and 123,822 third-class passengers, or 145,139 passengers in all, which shows an increase of 30,084 seats compared with the end of the preceding year. The total capacity of the freight cars was 94,350 tons, or an increase of 15,903 tons over the preceding period. The total mileage run by locomotive engines during the year under review was 24,917,429 miles, by trains 22,977,400 miles, and by passenger and freight cars 310,667,984 miles, showing respectively an increase of 21, 22, and 20 per cent. as compared with the preceding period. The quantity of fuel consumed was 439,791 tons of coal and 14,339 koku of liquid fuel.

The traffic returns for the last fiscal year show that the total number of passengers carried on the state and private lines was 99,061,889, while the goods transported amounted to 9,916,126 tons, besides luggage and parcels which aggregated 36,705 tons.

German Railroads in War Time.

"In time of peace prepare for war," is an old motto which is as good as it is old; and if we had made as much of it as the Germans have during the last thirty years, we should not have had our transport facilities in the hopelessly muddled condition that they were during the war with Spain.

I will give two instances or items showing what the Germans are doing and what we should have done; which is to say, what we should now do.

In Germany, as in the United States, the railroads are under various directions, corresponding to their various ownerships—the latter mostly Governmental. But there, more than in America, the principle is recognized that the good of the whole must—especially in time of war—override all other conditions. Situated as one is, like a nut between the jaws of the crackers (France and Russia) it is necessary not only to defend her frontier by fortifications and permanently garrisoned frontier troops, but also to be able to throw her entire available force on either frontier at the shortest possible notice—and "short notice" in German military matters means a very insignificant period of time. If we consider the difficulties which we should have to meet, had we to move 100,000 soldiers with all their appurtenances—cannon, horses, ammunition, pontoons, ambulances, field hospitals and kitchens, field telegraph stations and apparatus, etc.—from Chicago, Detroit, St. Louis and New Orleans to Boston, New York, Philadelphia and Savannah—we can well imagine that two weeks would not suffice for the work, if notice were given to-morrow. There may be a second Thomas A. Scott in embryo or in petto, ready to be discovered and utilized, to make the best of bad facilities and evolve order out of confusion—that is, one order out of twenty conflicting orders—and such a one, were he found, would probably work wonders with the material at hand, and under the circumstances. But that does not lessen the fact, that the material is insufficient, and the circumstances in the highest degree unfavorable.

The couple of instances which I here cite, out of a score which occur to me, are with reference (1) to the material, and (2) to its handling.

There are thousands of "third class" cars in the various kingdoms which compose the German Empire, and the railroads of which from the German "peace railroad system," which are so arranged that twenty minutes suffices to transform each of them into a well-equipped car for transporting horses. The end access doors, which are of the double-flap folding type, are screwed to; the glazed window-sashes and their frames, which are only screwed on to the insides of the car sides, are removed; a section of the side falls out, when unbuttoned or unscrewed; the door rails are there and the section of the side becomes a sliding side door. The transformation is complete, prompt and systematic. Printed directions for its accomplishment by the soldiers or by the railroad employees are at hand. This is but a trifle; but it will be remembered that so good an authority as the late Mr. Michael Angelo Breanarotti stated that trifles make perfection.

I come now to the time-table question. Germany is not so large but that if war were declared at noon to-day, the last train from a foreign country, entering it from one side, could not be cleared at the other boundary, in forty-eight hours; and in the same time freight trains could be notified that a new regime would soon come in. After that period, during which time the materials of war would be assembled at the various railroad shipping points, no blocks would occur which would prevent the prompt forwarding of men and munitions. There lies sealed up in every railroad station in Germany, the "General Railroad War Time-Table of the German Empire," which takes effect forty-eight hours after the declaration of war by Germany on any Power, or by any Power against Germany. This provides for the total suppression of all passenger and merchandise traffic and the conduct of the German military railroad system as an imperial unit, the principal object of which—in fact, the sole object—is, to carry soldiers and war material. If there is any place in between, then passenger and non-military freight traffic may be carried on; but the army and its needs are the main thing, and every conductor, engineer or other railway employee becomes after the forty-eight hours an employee of the General War Railroad System.

We should do well to imitate such thoroughness and such forethought. I am not in favor of war for settling quarrels, any more than I am in favor of bullies and foot-pads; but I am in favor of keeping myself in such physical condition that bullies will not attack me, and if I am in a dangerous locality, of being prepared to shoot the foot-pad through the side pocket of my overcoat if he attacks or even threatens me.

ROBERT GRIMSHAW.

Dresden, Germany.

Lowrie's Power Excavator.

Although so much has been done in recent years toward the development of plants for the conveyance of excavated material, little advance has been made in the application of power to excavation apart from dredges and steam shovels, the use of which is entirely limited to special fields. The steam shovel, while an extremely efficient and economical machine when working under favorable conditions for which it is adapted, may not be availed of in very many cases because it cannot work independently of a system of railroad tracks or some other means of rapidly removing the excavated material, and even even then it needs considerable depth and width and volume of cutting to be economical, and soft and dry material to be efficient; it cannot work below grade, to any extent, nor raise the material it excavates very high; it is out of place in city streets, is too heavy and cumbrous to be easily moved about except when upon a railroad, and requires usually an expensive plant of track, with cars and engines, to produce good results.

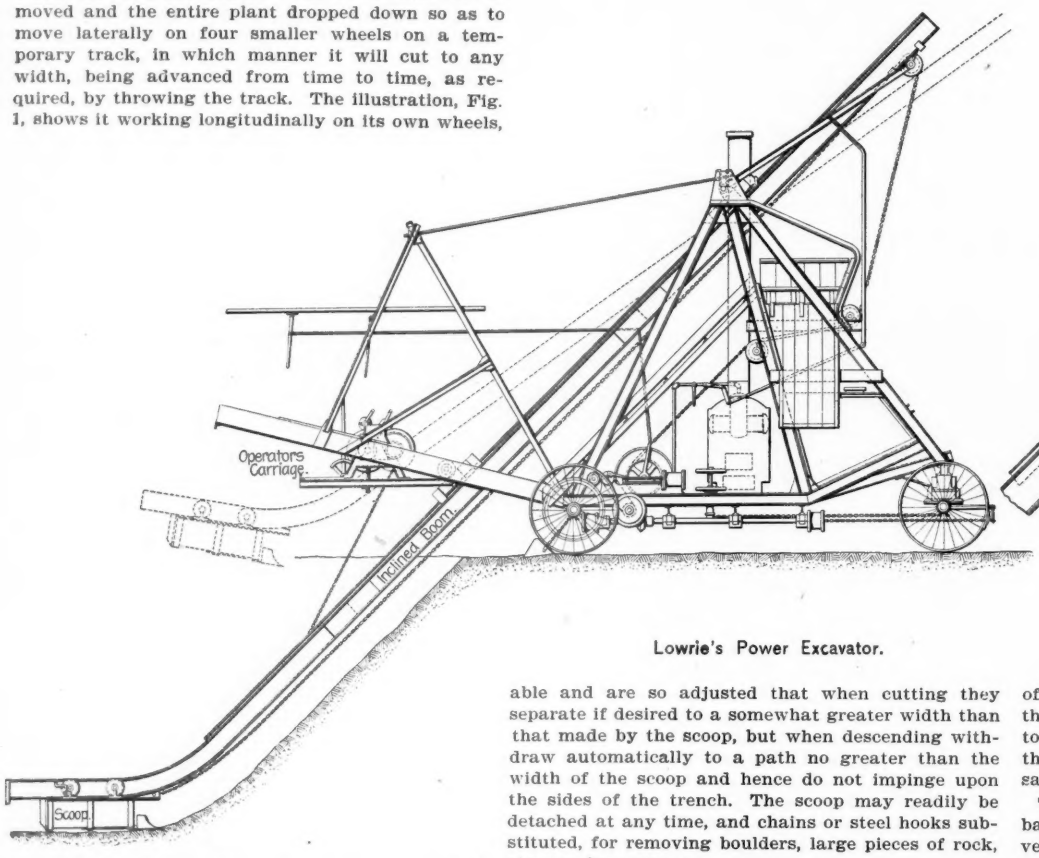
Modifications of the usual form of steam shovel, fitted for lighter service and greater range of work have, it is true, been tried from time to time, a number of such types having been introduced on the Panama Canal works, but with little practical success. Practically for ordinary excavations the methods and appliances of fifty years ago are still employed, the introduction of wheel-scrapers and ditching machines comprising nearly all the visible improvements, the pick and shovel still holding first place. Thus there would seem to be a very inviting field open to the inventor of a good power excavator.

Mr. Harvey C. Lowrie, M. Am. Soc. C. E., has rerently patented a steam excavator which though not yet on the market may be a successful and economical machine, containing novel and practical features which render it adaptable to a wide range of conditions. Though designed primarily for a trenching machine it is suited for other kinds of excavation, including railroad work, street grading and placer

mining, in each of which it seems to promise mechanical and economical efficiency together with celerity of operation and comparative freedom from obstructiveness.

It is designed as a self-contained, auto-motive plant carrying its own engines, boiler and water tank, weighing in all from eight to ten tons unloaded. It can readily be knocked down for shipment or removal to localities where no roads exist; but it is calculated to propel itself over any ordinary country road.

It can work either on its own wheels, without a track, forward and back, or the wheels can be removed and the entire plant dropped down so as to move laterally on four smaller wheels on a temporary track, in which manner it will cut to any width, being advanced from time to time, as required, by throwing the track. The illustration, Fig. 1, shows it working longitudinally on its own wheels,



Lowrie's Power Excavator.

as would be the case with a sewer excavation, but would also serve to represent the cross section of a railroad cut or canal or gravel pit or cellar, the wheels being supposed to be removed.

It will not be necessary to describe the apparatus in detail, but only the principal features that distinguish it. These consist of the inclined, curved boom and its manipulating machinery, the scoop or excavator proper, and the belt conveyor or other means of disposing of the excavated material. The inclined boom is made up of channels upon which the scoop travels, on four small wheels, from the pit up to the level of the conveyor or cart. The curved end is to permit of a horizontal movement of the scoop at the beginning of each cut; it is connected with the main frame so as to slide and pivot and is also connected and supported from a little truck, called the operator's carriage, running back and forth on four small wheels between the flanges of a pair of supporting channels which project from the frame. The carriage is held to the track and permitted to move on it by a rack and pinion movement in connection with machinery under control of the operator, who thus can readily move the carriage up and down the track, carrying the boom out or in and by the rotation of a pair of windlasses, also on the carriage, raise or lower it to any height, depth or inclination within the limits of the size of the machine. After the boom is properly set it remains fixed for excavating, but can be moved into any new position at the will of the operator.

The scoop by means of its wheels is supported, guided and controlled by the flanges of the boom channels; it is raised by a chain driven by a winding engine on the main frame that can be worked from the carriage, passing over a pulley which slides on the boom near its upper end (see Fig. 2), and is lowered by gravity.

The scoop is of varied design; it may dump through the rear, which is guarded during ascent by a door which slides to close and upon which the main draft of the raising chain is made. On reaching the proper height to be discharged the scoop is automatically latched, Fig. 2, so as to be held stationary, the power simultaneously released, the door falls and the dump is instantly made; the scoop is then automatically, or otherwise, unlatched and returns by gravity to the pit. In another form the scoop overturns for the discharge.

The discharge is into a hopper built into the plant, and thence to either or both sides of the plant at will and may be lead out upon the ground or shute or into carts, wagons or any form of conveyor; in many cases belt conveyors may be connected to work from the power of the main plant so as to automatically and continuously discharge the excavated material into its final place; this is especially desirable for refilling over pipes in street trenches and similar situations where it can both excavate and back-fill simultaneously and is expected to proceed so rapidly as to avoid sheeting the trench, otherwise necessary in much material, which would yield to longer exposure of the banks.

The scoop has attached to it right and left hand plows which precede it in the operation of loading and break up the material; these are readily detachable and are so adjusted that when cutting they separate if desired to a somewhat greater width than that made by the scoop, but when descending withdraw automatically to a path no greater than the width of the scoop and hence do not impinge upon the sides of the trench. The scoop may readily be detached at any time, and chains or steel hooks substituted, for removing boulders, large pieces of rock, stumps, logs, etc.

The cuts made are in successive slices of uniform dimensions, leaving the smooth surfaces ordinarily made by a drag or wheel scraper; by substituting special scoops the bottoms of trenches can be exactly shaped and graded for pipes.

For railroad cuts, canal beds and similar cross cutting, by giving the boom the inclination of the slopes the whole operation can be finished at one setting when the cut is not too deep, and otherwise by means of beams, in successive stages.

In grading city streets and country roads it leaves the finished surface at all times smooth, the plowing being done only just as needed. In stripping rock cuts where often neither carts nor steam shovels can be used, also in deep cuts too short for steam shovel work, this excavator would be particularly useful.

Clark Fisher's "Triple Fish" Rail Joint.

The engravings herewith show the latest form of rail joint designed by Mr. Clark Fisher of Trenton. It is entirely different in principle from the Fisher bridge joint, which is so long known and so well known that it is hardly necessary for us to go again over its theory, design and performance. The "triple fish" joint, however, as now in use, is an important modification of the older Fisher bridge joint and is well worth careful consideration, for probably 99 out of 100 railroad men will admit without debate that they are not using any thoroughly satisfactory joint to-day. Whether or not this triple fish joint will fill the bill has yet to be demonstrated, but, as we have said, it is worth careful consideration.

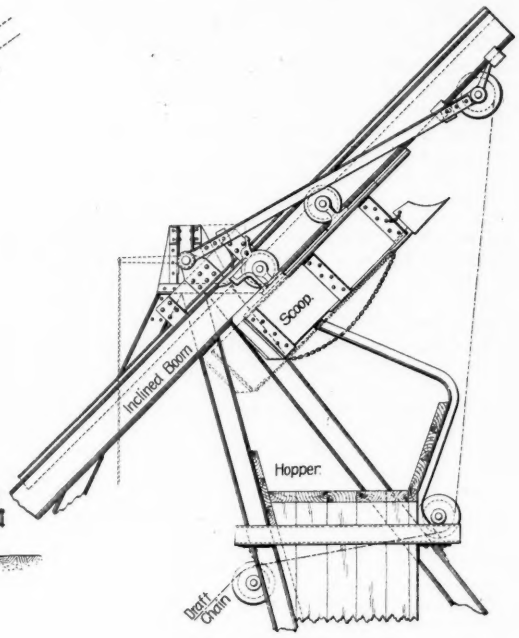
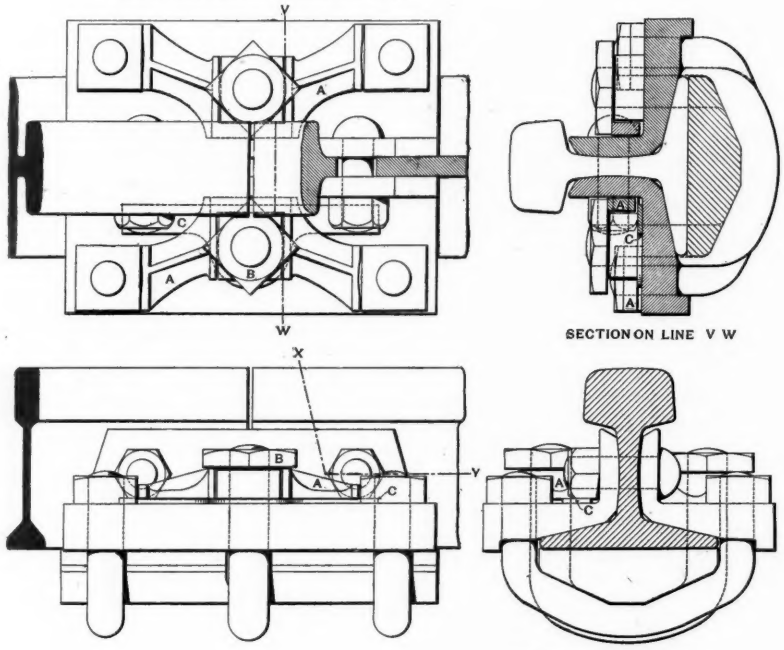


Fig. 2.

The essential parts of this joint are three "fishing" bars—fishing the rail ends in two directions, viz., vertically and laterally, and the bolts and nuts securing them in those two directions. Vertically the six bolt ends secure the heavy lower bar and the horizontal portion of the specially shaped "angle bars" enclosing between them the whole of the rail flanges. Laterally the two bolts through the rail stems hold them in direct contact—iron to iron, since they do not extend high enough to touch under the head. If both sets of bolts do their duty there should be no wearing, as no movement should occur except that of contraction and expansion of the rails themselves endwise.

As the efficiency of the joint depends upon these bolts, there must be no loosening of nuts, and a positive lock for the U bolt nuts is provided, in AA, of wrought or malleable iron, over which to prevent rattling or removal are the nuts BB, and for the track bolt nuts is provided the liner C. These, however, are mere additional details and may be omitted

Plan; also section of Rail on X Y.



The Clark Fisher "Triple Fish" Rail Joint.

or other nut locks may be used. Where these joints are used on heavy grades, or for other reason have an unusual tendency to creep, the angle bar members of the joint may be extended over the ties for spiking.

It will be seen that there is no contact with the under side of the head. The rail is supported entirely from its base. The central U bolt (1⅛ in. in diam.) is exactly at the ends of both rails and has its vertical ends as close in to the stem as possible, with room to turn their nuts. This requires circular clipping out of the flange corners, which, of course, does not in any way injure or weaken the rail. The other two end bolts (of one inch diameter), passing outside of the rail flange edges, do not require any clipping. One hole only is drilled through the web of each rail end for the track bolt.

The reader will notice a radical difference between this new joint and the well-known Fisher bridge joint, in principle and construction, in that no special preparation of ties on elevated roads and bridges is necessary, which was one of the standing objections to the older joint. A line of rails can be bolted up and thrown in with this joint as readily as with the ordinary angle splices, or, at least, all that would be necessary would be a little moving of a tie here and there if the spacing does not happen to fall exactly right.

Incidently, an additional advantage results in the use of this joint, viz., the usual "bonding" for electrical signals can be dispensed with, because the lower and upper members, of large section, held under a direct pressure of more than forty tons by the six nuts of the U bolts, furnish more than sufficient conductivity for signal purposes. Probably the surfaces of rail ends and joint in contact should be freed from scale at first, after which the friction of daily expansion and contraction would prevent any accumulation of rust, keeping them clean enough to maintain good electric contact.

One of the old objections to the Fisher joints is nearly removed in this one, namely, their cost over the ordinary angle splice joints, as there is but little difference in the cost of the triple fish joint and that of the heavy, six-bolt angle bar joint used by first-class roads on their 85 and 90-lb. rails; compared with the latest form of these joints the "triple fish" is said to cost less. We judge, however, that by this time railroad companies have pretty generally learned that within reasonable limits they can well afford to pay more for joints than they are now paying if better performance can be got out of them. The first cost of a track joint is about the last place for economy in track construction.

These joints have been in use for about 15 months on the Pennsylvania Lines West of Pittsburgh, near Ft. Wayne, a thousand or more being in track there, fitted on 85-lb. rails 60 feet in length. A smaller lot of these joints has been in use on the Long Island Railroad near Flushing for six months or thereabouts and recently a few have been placed in the southbound track of the Philadelphia & Reading at Langhorne station. By this time service results of some value must be available, but we have not endeavored to get any opinion other than the general expression that the joints has given satisfactory service. It is a curious fact that at Langhorne the Philadelphia & Reading have 200 of the Fisher bridge joints in their main track on their 90-lb. rails which have been in continuous use something over nine years, being still apparently in as good condition as when originally placed there.

TECHNICAL.

Manufacturing and Business.

The Wagner Palace Car Company has declared an evening-up dividend of ⅛ of 1 per cent. Its next dividend will be upon Pullman stock.

W. J. Carlin Co., of Pittsburgh and New York, has bought six new 9 in. x 14 in. Dickson saddle tank locomotives, of 36 in. gage, for use in connection with steam shovel work.

The Wm. Cramp & Sons' Ship & Engine Building Co. have declared the regular quarterly dividend of 1¼ per cent., payable Dec. 15.

The Richmond Locomotive & Machine Works want, for file and reference, makers' and supply companies' catalogues of machine tools, railroad equipment, miscellaneous machinery, electrical apparatus, supplies, etc.

E. H. Bankard, Purchasing Agent, Baltimore & Ohio at Baltimore, Md., is offering for sale 17 passenger engines, with 17 in. x 24 in. cylinders, which have been found to be too light for service on that road.

The Sargent Company reports rapid progress on its new works at Chicago Heights, and expects to be running the iron department about the first of the year.

The Carbon Steel Co. has moved its St. Louis office from the Union Trust Building to the Lincoln Trust Building.

Justice Cox, Jr., & Co., Limited, of Bullitt Building, Philadelphia, is offering for sale 3,700 tons of relaying rails, some of which are 35-lbs., some 56-lb., and some 70-lb., in addition to a number of locomotives and passenger and freight cars.

The Pantasote Company, of New York City, has been awarded a silver medal and diploma for its exhibit at the National Export Exposition at Philadelphia. The exhibit of the company was elaborate, consisting of a cottage built and furnished in antique style. The walls, ceiling and furniture were all finished in Pantasote with embossed designs.

Iron and Steel.

The Carnegie Steel Co. of Pittsburgh has a contract from the Merchants' & Manufacturers' Bank of that city for 83 tons of Harveyized plate for vaults for the bank.

The Pittsburgh Reduction Co. of New Kensington, Pa., and Niagara Falls, N. Y., will, according to reports, build an aluminum plant in Canada near the Shawenegan Falls of the St. Maurice River, near Quebec, to cost in the neighborhood of $1,000,000.

A blast furnace will be built in Ellwood City, Pa., by Youngstown, O., capitalists.

The Illinois Steel Co. has completed a new finishing end for their small trains at the Milwaukee works, and have a new machine shop at the same place well under way.

The Falk Co., of Milwaukee, Wis., are building a steel foundry adjoining their present plant in Milwaukee, to make steel castings. It will be equipped with the Wellman-Seaver Co.'s tilting open-hearth furnaces and will have a daily capacity of 30 tons. Machine shops, blacksmith shops and a power house to cost about $100,000 are also being built.

Drake & Stratton Co., Ltd., Pittsburgh, Pa., have a contract from the Fayal Mining Co. to strip 2,500,000 yards of earth from the Fayal iron ore mines on the Mesaba range in Minnesota. The contract is worth $1,250,000.

The Carbon Steel Co., Pittsburgh, Pa., last week secured control of a tract of four acres of land, about 400 ft. along the Allegheny River. The company is making improvements which will increase their capacity. This company makes acid open-hearth steel. It has two 15 and six 30-gross ton furnaces, built in 1888 and later years.

The Logan Mfg. Co. will build a large plant to make steel and iron castings, on the land recently acquired in Phoenixville, Pa.

The Grand Rapids Malleable Iron Co. of Grand Rapids, Mich., proposes to build additions to its present plant.

The Virginia Rolling Mill Co. has been incorporated in New Jersey to mine and sell coal and make iron and steel. The capital is $200.000.

The Iron Trade Circular of Birmingham has this to say regarding the condition of the iron and steel trade for the week ending Nov. 18: "Notwithstanding the large output of steel rails, makers are quite unable to cope with the demand. The American makers are crowded, so all inquiries are coming to this country. Only recently a Continental buyer of steel rails advertised for about 6,700 tons. Not a single English or American tender was received, the only one being from an Italian firm; and in that case the price quoted was so high that the purchaser has decided to withhold his order until the market is more favorable. He will, no doubt, have to withhold the order for a long time, as the Americans are reported to have sold their entire output for the whole of next year, and British firms are fast filling up their books. Prices have further advanced, as the basis price for heavy rails is now £7 per ton at works. The condition of the steel trade has been illustrated by a Nottingham firm which undertook to supply the Yarmouth Corporation with steel and iron work for a dust destructor. The firm informed the Council that five of the principal makers of girders with whom they had been in the habit of doing business had absolutely declined to accept their order 'on account of the glut of their order book.' Two steel girders that were tendered for at £226 a short time back cannot now be supplied under £438."

The Lewis Foundry & Machine Company has bought land between Montour Junction and Coraopolis, Pa., to which the works will be removed from Lawrenceville. It is intended to make additions to the works.

At a meeting of the Carnegie Steel Co., Ltd., in Pittsburgh, Dec. 5, Mr. H. C. Frick announced his intention of resigning as Chairman of the Board of Managers to remain as a consulting partner.

The Central Steel Co. was incorporated in Indiana Dec. 5, by Pittsburgh and Indianapolis capitalists, with a capital of $240,000. The new company has bought the Premier steel plant at Indianapolis, which has been idle for several years. N. J. Carlin of Pittsburgh is Treasurer, and Crawford Fairbanks of Terre Haute, Secretary.

The Steel Car Forge Company, of Pittsburgh, was chartered Dec. 2 in Pennsylvania, as a reorganization of the Baker Forge Co., with a capital stock of $200,000 and these directors: James H. Fraser, J. W. Chalfant, Jr., James S. Crawford, E. E. Boyd and Harry O. Evans, all of Pittsburgh.

Inquiries in the New York market for small lots of steel rails, aggregating a total of some 10,000 tons, which, according to local mill agents, if it were possible to make deliveries, would result in immediate orders from Mexico, Cuba, Australia and South America.

The miners of Lake Bessemer ores have announced their prices for the season of 1900-1901. The figure decided upon is $5.50 at Lake Erie and Lake Michigan ports for the Norrie grade. It was $2.53 last year.

The Jefferson Iron Co. has taken over the 80-ton blast furnace, the ore lands and the machinery for a rolling mill at Jefferson, Tex., formerly owned by the Lone Star Iron Co.

Rogers, Brown & Co., New York, have an export order for 1,000 tons of pig iron for shipment to Italy.

A Pittsburgh dispatch states that a plant to cost more than $1,000,000 and backed by Mr. Andrew Carnegie, J. P. Morgan and others, will be built on the Monongahela River, 16 miles above McKeesport, to make iron and steel parts for furnaces and locomotives. A tract of land of 40 acres has been bought.

The work of building the Warwick Iron & Steel Co.'s plant at Norristown, Pa., was started last week. The contract for the engines has been let to the E. P. Allis Co. of Milwaukee. The Sterling Water Tube Boiler Works, Sterling, O., will supply the boilers. A contract has been let to John B. Pollock & Co., Youngstown, O., for a new furnace.

The new plant of the Tennessee Coal, Iron & Railroad Co. at Endsley, Ala., a suburb of Birmingham, was put in operation Nov. 30. The work of building the plant was started July 14 of last year and has cost $1,500,000. About 1,000 tons in the form of billets, slabs and rails will be made each day. A large part of the product will be used by the Alabama Steel & Wire Co. A contract had been made to export 2,000 tons of pig iron to Milan, Italy, during the next three months at current prices. The entire product is sold ahead for the whole of 1900.

At a meeting of the directors of the Dominion Iron & Steel Co. in Montreal, a contract was let to Messrs. Drummond, McCall & Co. for four miles of 36-in. cast iron water pipe for use at the company's plant at Sydney, Cape Breton. Contracts have been let amounting to about $156,000. The pipe will be made at the Londonderry, N. S., Iron Works, of which Drummond, McCall & Co. are lessees. About 1,500 men are now at work at the new plant of the Dominion Iron & Steel Co. It is estimated that the following expenditures will be made on this work within the next two years: Blast furnaces, $2,500,000; steel mill, $1,500,000; coke ovens, $1,250,000; docks, foundations, etc., $1,000,000, making a total of $6,250,000.

A charter has been granted the Hussey-Truxall Steel Company, of Pittsburgh, Pa., with a capital stock of $1,000. Ephriam Truxall, J. S. Speer, O. P. Curran, Jr., H. E. Barlow, J. P. McCord, of Pittsburgh; C. G. Hussey and J. D. Scott, Allegheny, are the Directors.

A despatch from Halifax, N. S., states that another steel plant will be built at Sydney, Cape Breton, about 10 miles from the plant now being built by the Dominion Iron & Steel Co., of which H. M. Whitney is President. The new syndicate is said to be composed in part of members of the Nova Scotia Steel Co.

Interlocking.

The Standard Railroad Signal Co., of Troy, N. Y., has taken a contract to put in two low-pressure pneumatic interlocking machines for the Chicago & Western Indiana. They are to be at 12th Street and at 16th Street, Chicago. These machines will have about 50 levers each.

Gondolas with Steel Underframes.

The Philadelphia & Reading Company has under contract 1,000 high-side gondolas to be built by the Pressed Steel Car Co. These are to have steel underframes with wooden floor and sides and to have drop bottoms. They are of 70,000 lbs. capacity.

Electric Car Heating Litigation.

The suit recently brought by the Consolidated Car Heating Company against Palmer and Monson Street Railway Company, on the McElroy patent for steam heating by electricity, No. 608,211, dated Aug. 2, 1898, has been dismissed. The Palmer and Monson Street Railway Company adopted the Gold System of electric car heating and the Consolidated Car Heating Company brought suit for infringement. The Gold Car Heating Company defended the suit. The two interference suits in the United States Patent Office relating to valuable improvements in electric heaters prosecuted by the Consolidated Car Heating Company in support of the application of James F. McElroy and by the Gold Car Heating Company in support of the application of Edward E. Gold, have both been decided in favor of the Gold Car Heating Company on the original hearings and on appeal.

Steel Water Tanks.

In a recent pamphlet issued by the Chicago Bridge & Iron Co. considerable space is given to steel water tanks and stand pipes for locomotive water stations,

and engravings are presented showing such stand pipes on the Chicago, Rock Island & Pacific. The following extracts are taken from the argument for steel construction:

Wood construction for storage of water is used on account of its less first cost; however, metal supports for tanks are used. We are not offering steel in competition with wood as to its first cost, but it is a fact that an all-steel structure can be built as cheaply as steel supports and a wood tank. We have no knowledge of a renewal of a metal tank, but one in service thirty years, recently inspected, is in perfect condition. While there may be wood tanks lasting thirty years if repeatedly repaired, it is exceptional for one to last ten years without renewal of parts. Interested parties claim greater life for wood tanks than for steel, in support of which they instance the fact of the tanks outlasting two sets of metal hoops. We know that hoops for wood tanks, being ⅛ in. thick, have to be frequently renewed. Due to leakage, hoops are alternately wet and dry, which taken in connection with the inaccessibility for painting causes rapid deterioration. Now it is obvious if the wood tank is always full of water it would last indefinitely. But this condition does not obtain in practice, as from the nature of the case a tank is in all conditions between full and empty. If it is assumed in argument that the tank is always full, it follows there is no occasion for the tank, as a supply that will always keep a tank full will supply the locomotive tender direct. The cost of operation may be considerably reduced with the use of steel tanks, due to the fact that the pumping may be carried out in the most economical method, while with wood tanks frequent pumping is a necessity to keep the tanks from collapsing.

Two types of metal tanks are furnished for railroad service. The elevated design conforms to the practice of using a tower under the tank, while the stand pipe type is best suited for large units of storage, especially where the tank is placed some distance from the tracks and the water column is used. The lower portion of a flat bottomed tank is an excellent receptacle for settlement of sediment, which can be removed as occasion requires. A receptacle of smaller dimensions can also be arranged in the elevated tank, which has provision for removing the sediment without interruption to the service.

Freight Cars for Russia.

We have recently talked with a gentleman from Moscow, who has exceptional means of information, who says that within five years Russia will have at least a million freight cars in service, there being about 500,000 now. This suggests the amount of business which the Westinghouse Air Brake Company has before it in the equipment of these cars. The same gentleman informs us that there is an excellent opportunity to furnish couplers for the Russian freight cars if American makers will carefully study the situation and adapt their appliances to the Russian uses.

Compressed Air.

We have mentioned elsewhere the statement made by Mr. Vreeland to the effect that the Hardie compressed air motor car will be tried on the lines of the Metropolitan Street Railway Company in New York City alongside of the Hoadley-Knight cars. Some of these Hardie cars are now building at Rome, N. Y., for service in New York City. This week the first compressed air motor cars began running in the city of Rome on the lines of the Rome City Railway Company, which have been rebuilt.

A New Substitute for Leather.

L. C. Chase & Co., of Boston, Mass., makers of the Goat Brand mohair plush, have lately put on the market a substitute leather for upholstering car seats and backs and for car curtains and head linings. The product is the result of several years of experimenting. It is claimed for the material that it will not scratch or crack, that it is not affected by the weather and that it is stain and water-proof.

Pneumatic Tool Litigation.

The following circular is signed by the Chicago Pneumatic Tool Company and the Standard Pneumatic Tool Company: "We wish to notify all our customers and the trade in general that, in the patent litigation entered into between the Chicago Pneumatic Tool Company, Joseph Boyer, the Standard Pneumatic Tool Company and the Chouteau Manufacturing Company, all suits have been dismissed by the advice of their respective attorneys, they recognizing that the Boyer and Chouteau patents cover the fundamental principles of all pneumatic hammers, without the combined use of which no successful pneumatic hammer can be made.

"Recognizing the value of their respective claims, they have purchased licenses from each other covering their present style of hammers.

"We consider this action necessary for the protection of users of our respective tools."

Electrical Machinery for the Manhattan Elevated RR., New York.

A contract has been awarded to the Westinghouse Electric & Mfg. Co. for some of the heavy generating machinery for the new power house and for the transforming apparatus to be used at the sub-stations of the Manhattan Elevated. This, with the contracts already given for engines, boilers and other apparatus, as noted in our issue of July 14, page 510, provides for practically all the station machinery. The apparatus covered by the contract just let includes eight 3-phase alternating current generators each of 6,650 h. p., with the stepdown converters and other necessary apparatus for the sub-stations. These converters will transform the alternating current at the power station into a 500 volt direct-current to be used in running the cars. The 6,650 h. p. generators will, it is believed, be the largest ever built. Their diameter will be over 40 ft.

Air Power Cars in New York.

Last week President H. H. Vreeland, of the American Air Power Co., stated in an interview that he proposed in the near future to make competitive trials of the Hardie and of the Hoadley-Knight air motors. Cars of the former type are now running in Chicago and over 20 of the latter type are running in daily service on the 28th and 29th street cross-town lines in New York.

Machinery for Australia.

The Westinghouse Electric & Manufacturing Co. has a contract for half a million dollars' worth of electrical machinery and supplies, for the equipment of the entire traction system of Adelaide, New South Wales, Australia. James O. Callender of Sydney, Australia, is Consulting Electrical Engineer of the Adelaide Development Co., which recently bought all the tramways of Adelaide, amounting in all to about 54 miles of road.

Pneumatic Tool Litigation.

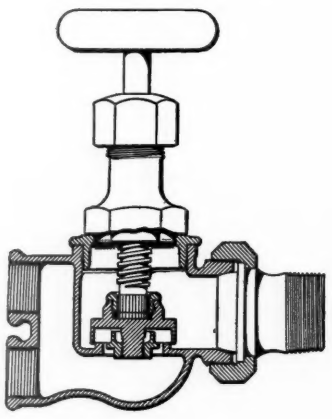
The Q & C Co. of Chicago has issued a circular stating that it is not involved in the litigation now pending between various makers of pneumatic tools and that full protection will be given to buyers of tools made by the company. In addition to pneumatic hammers and riveters, the Q & C Co. will shortly put on the market drills, for both wood and metal, and hoists.

Standard Threads for Wrought Iron Pipes.

At the last convention of the Master Mechanics' Association a committee made a report on "Standard Threads for Wrought Iron Pipes." The summing up was that there is a general understanding among the railroad companies that the Briggs table of threads and dimensions is the adopted standard. Out of about 60 replies to the circular, there appeared to be only eight roads specifying by what templates the standard should be tested, and of these eight, six specify the Pratt & Whitney Co. templates. The committee therefore recommended the adoption of the Briggs standard as determined by the Pratt & Whitney Co. gages as the standard threads for wrought iron pipe and couplings. This committee consisted of Messrs. C. H. Quereau, chairman, W. H. Marshall and H. Monkhouse. The Association adopted the Briggs standard as determined by the Pratt & Whitney gages as the standard of the Association. We learn now that the Chicago, Burlington & Quincy Railroad Co. has adopted standard sizes and screw threads for its wrought iron pipes in accordance with this action of the Master Mechanics' Association.

The Collis Circulating Valve.

The Collis valve for radiators shown in the accompanying engraving is not an untried device put on the market as an experiment, but is in already considerable use. This valve attached to a radiator assures circulation of dry steam and only one valve is required for each radiator; and the circulation will be active and positive whether the valve is open, partly open or closed. With this valve there is a complete circulation in the apparatus when the radiators are disconnected, and they can be disconnected and connected again without shutting off steam from the entire system. Furthermore, this valve can be used with any of the automatic heat regulating systems by removing the regular bonnet and substituting the diaphragm bonnet and trimmings of the regulating system that may be in use. These valves are made by Jenkins Bros. of New York, in three sizes for pipes 1¼, 1½ and 2 in. in diameter.



The New East River Bridge.

Mr. O. F. Nichols, Principal Assistant Engineer new East River bridge, delivered an address Dec. 1 before the Broadway Merchants' Association of Williamsburg and delegations from the various Boards of Trade in Brooklyn. He said that owing to the financial inability of the city to permit the letting of new contracts in 1896 and the difficulty now of getting large quantities of steel promptly at any price, it was not possible to tell just when the new bridge would be ready for use, but that the work already done might be fairly considered to represent one-half of the whole, both in time and cost. The steel towers and the four cables are to be built next, he said, and after that the building of the suspended structure and of the approaches on either side of the river could proceed independently of each other.

Mr. Nichols said the cost of the bridge proper would probably be about eight million dollars, or $3,500,000 less than the cost of the present East River Bridge, but that the cost of the real estate which must be taken would probably make the total cost greater than that of the older highway across the East River. The value of the new bridge to the city, he declared, would however be vastly greater than its cost. The present bridge, he said, was to-day paying 15 per cent. per annum on its entire cost in the reduction of railroad fares to those who use it, and the new bridge, he was sure, would soon be declaring the same sort of dividends, but in a greater proportion.

As to its aesthetic features, he said: "It is a sound architectural principle that if you have a load to carry, there is no disgrace in being seen carrying it. I believe that when this bridge is completed the intelligent critic, as well as the ordinary observer, will be impressed with the main fact that here is a structure built under peculiar and somewhat hampering conditions which supports safely and carries conveniently a great load, a mighty and civilizing stream, and that it will be perfectly evident that it does this, and why, and that the immensity of its proportions and the grandeur of its labors will justify the simplicity and sincerity of its design."

Opening of the Charles River Bridge.

The Charles River drawbridge at Boston, a description of which was published in the Railroad Gazette of November 24, was formally opened to traffic at 11:30 a. m. Monday, November 27, by Acting Mayor Barry of the City of Boston, City Engineer Jackson and Principal Assistant Engineer Cheney, who directly supervised the construction of the structure.

Uniform Dimensions for a Typical Box Car.

The committee of the American Railway Association considering the question of the dimensions of a typical box car has started the discussion among the railroad clubs, thus illustrating the uses to which those clubs are now being put by the senior associations. We gave last week, page 808, extracts from the remarks made at the meeting of the Western Club by Mr. Rhodes, Mr. Crapo, Mr. Schroyer, Mr. Robert Miller and Mr. Marshall. At the meeting of the New York Club in October the question was taken up by Mr. Waitt and Mr. Sanderson. We shall not make any extracts from their remarks, as the subject was pretty well covered in the matter which we printed last week.

A Cement Plant in Michigan.

The Osborn Co., Cleveland, O., will design and superintend the building of the Peninsula Portland Cement Co.'s plant at Woodstock, Mich. Contracts for the entire plant will be awarded as soon as the plans and specifications, which are now being prepared, can be completed.

THE SCRAP HEAP.

Notes.

The headquarters of the Brotherhood of Railway Trainmen has been removed from Peoria, Ill., to Cleveland, O.

The Canada Atlantic is preparing to adopt the standard code of train rules of the American Railway Association.

During the month of November the number of engines attended to at No. 2 roundhouse of the Pennsylvania Railroad at Harrisburg averaged 106½ a day. This is said to indicate the largest number of freight trains ever run into Harrisburg in a single month.

The North Carolina Supreme Court has sustained a decision, rendered in Burke County, imposing a fine of $1,000 on the Southern Railway for giving a free pass to a doorkeeper of the Legislature in 1897.

A press dispatch from Topeka says that the United States Court has declared unconstitutional the law of Kansas passed about a year ago establishing the "Court of Visitation" in place of the former State Railroad Commission.

The express car of a train on the Southern Railway was robbed of $2,000 near Branchville, S. C., on the night of Dec. 1, by five unmasked men who overpowered the messenger and escaped from the train before anyone outside the express car knew that they were on the train.

The New York, New Haven & Hartford Railroad and the Pullman's Car Company have agreed to terminate the contract under which the Pullman Company runs parlor cars between Boston and Fall River. The contract had 15 years yet to run. The Pullman Company continues to run sleeping cars

twice daily each way between Boston and Washington.

The Delaware & Hudson has increased the pay of locomotive firemen as follows: On passenger engines, from 1¾ to 1⅞ cents a mile; on mogul freight engines, from 2 cents to 2⅛ cents a mile, and on consolidation freight engines from 2 cents to 2¼ cents a mile.

The Richmond, Fredericksburg & Potomac has increased the wages of yard conductors and brakemen 10 per cent.

Oil for Locomotive Fuel.

The Southern Pacific is building underground tanks at a number of stations on its line between San Francisco and Los Angeles, for the storage of fuel oil to be used in locomotives. Officers of the road, when asked about the use of petroleum in locomotives, make the same answer as heretofore; that the kind of locomotive fuel used is liable at any time to be changed, in consequence of fluctuations in the oil market. When the price of oil advances locomotives are at once changed to burn coal, while if the cost of oil again falls off, the use of liquid fuel will be resumed. From the reports concerning the construction of tanks, however, it would seem that the officers of the road entertain an increasing confidence that the supply of oil will be plentiful enough to keep the price within the limit at which the company can afford to use oil for fuel.

Chicago Elevated Railroads.

The Northwestern Elevated has asked the City Council to extend the time for completing the road from Dec. 31, 1899, to Oct. 1, 1900, and the matter has been referred to the Committee on Railroads. The reasons given for the request are the difficulty of getting delivery of structural material, and the strikes of the workingmen. The work of construction was begun in 1895 and the road will have about 25 miles of track. This is the fourth time that an extension has been asked for.

The Union Consolidated Ry. Co., owning the elevated Loop in Chicago, has refused to pay the compensation due to the city under its ordinance or to grant access to its books. The company gives as a reason that the city, by repealing the clause in the ordinance allowing the company to build bridges connecting the Loop with stores along its line, has broken the contract.

A Chicago Tunnel Scheme.

At a meeting of the City Council of Chicago, Nov. 27, Commissioner of Public Works McGann submitted plans and estimates made by City Engineer Ericson for a link between the North and South Sides. The report says that a single tunnel is impracticable and the plan made is for a double tunnel 4,050 ft. long from Lake Front Park north under the river near its mouth to Ohio St., with branches east and west to the North Shore Drive and to St. Clair St. The north open cut would be 1,320 ft. long and the south open cut 880 ft. The tunnels would be 31 ft. The estimated cost of a bore is $3,329,286, and of a double, $5,468,912.

The Paris Conference on Testing Building Materials.

During the Paris World's Fair to be held in 1900 there will be an international congress on the methods of testing building materials. This congress will be held during the period extending from July 9 to July 16, excepting July 14, which is a national holiday. The organization committee requests prompt information as to those who expect to attend. It is proposed "to arrange some festivals in Paris or in the neighbourhood during the session and also, after it is closed, some excursions, workshops visiting. We will indicate later on, when the programm will be definitive and the expense valuated, what will be the price of each of these festivals, excursions—for each of which special tickets will be delivered to the member, wishing to subscribe for any of them." This quotation will serve not only to give some information to our readers, but as an example of the language in which the circular is written. Anybody wishing to communicate with the committee on the matter can probably do so by addressing "The General Secretary, Debray, Universal Exposition of 1900, Ministry of Commerce, Paris, France." At least that is the way that we should start a letter if we had occasion to send it and using the information contained in the circular, although the matter seems vague.

Progress in Steam Navigation.

In September last Sir William White spoke before the British Association and gave a summary of the progress made in ocean steamship construction since 1840. At that time the side-wheel ship Britannia, of the Cunard Line, 207 ft. long and 750 h. p., maintained a speed of about 8½ knots on a coal consumption of 40 tons a day. Since then the speed has been increased to 22½ knots and the time of making the trips reduced about 38 per cent. Steamers have more than trebled in length, about doubled in breadth and increased tenfold in displacement. The engine power has been made 40 times as great and the ratio of horse-power to the weight carried has increased fourfold. The rate of coal consumption is, according to Sir William White, now about one-third of what it was in 1840. The largest ship afloat, the Oceanic of the White Star Line, is 685 ft. long, with a tonnage of 25,000 tons and a speed of about 22 knots. The Kaiser Wilhelm der Grosse of the North German Lloyd Line, while 60 ft. shorter than the Oceanic, has maintained a speed of 22½ knots and a larger steamer is now being built, the Deutschland, 660 ft. long, 23,000 tons, 33,000 h. p., with an estimated speed of 23½ knots. Sir William White believes that the maximum of size and speed has not been reached, and says that the increase of length and weight favors the better maintenance of speed at ease, and that the tendency will be with increased speed to secure even greater regularity of service than at present; and, furthermore, that quicker trips will, to some extent, diminish risks.

The London Under-Thames Railroad Tunnels.

Among the railroad schemes lodged for Parliamentary consideration is one which is mainly of interest, in that it involves yet another tunnel under the Thames. The tunnel will be constructed a good way down toward the river mouth, below Erith, and it is set on foot by the Purfleet & Gravesend Junction Railway, who propose to connect the London, Tilbury & Southend and the Southeastern systems. The capital would be found by three companies, viz., the Midland, Southeastern & London, Tilbury & Southend.

The City & South London Electric Railway Company's extension to Moorgate Street is now completed, and a recent visit to the power station found things in a very forward state. The extension will be opened in December. A new line in two separate tunnels runs beneath the Thames on the Tower side of London Bridge. These tunnels pass below the existing station at King William Street at a depth of 30 ft. The King William St. station will be closed and part of the line forming the new junction will be handed over temporarily to the City & Brixton Electric Railway Company. The new tunnels to the city are constructed beneath the foundations of the old St. Mary Woolnoth Church, which had to be held up while operations proceeded.

Supreme Court Decision Against the Addyston Pipe Trust.

The United States Supreme Court on Dec. 4 sustained the decision of the Circuit Court of Appeals, Sixth District, declaring illegal the agreement of certain manufacturers of iron pipe in different States to control prices. The Addyston Pipe & Steel Co., of Cincinnati, formed an association with other manufacturers in Louisville, Anniston, Chattanooga and elsewhere, under which the territory of the United States was divided and allotted to different makers, and they agreed not to bid against one another, except under well-defined regulations; and evidence was given showing how prices had been made much higher than they would have been if competition had been unrestricted. On the trial before the Supreme Court, the appellants argued that the power of Congress, under the Constitution, in the regulation of interstate commerce, extended only so far as to authorize that body to prevent unconstitutional legislation by States and municipalities and to regulate common carriers, elevator companies and gas and water companies; it did not include a general power to interfere with the business of private citizens. The decision, by Justice Peckham, denies the soundness of this argument, and holds that the agreement was a plain violation of the anti-trust law of 1890. It is expressly stated that the decree is to have no effect on the doings of the association within a single State.

It is to be observed that this was a plain case of separate companies or corporations, situated in different States, making a definite agreement to maintain prices. Practically all of the large trusts, so called, now prominent in the public eye are single corporations, performing all their essential acts at one city, and, from the standpoint of Federal legislation, differing from ordinary business concerns only in magnitude.

Gas Traction in England.

Although there are several systems of street railroads in England worked by gas, it cannot be said that the company which has been responsible for the construction of these lines has been a financial success, for it is now in process of liquidation. It is considered, however, that the business is a good one, and hopes of satisfactory reconstruction arrangements are entertained. The company has cars working under the Lührig Holt system at Blackpool, Neath and Trafford Park; altogether about 15½ miles of way. It is stated that the company has been always in a tight corner for money. On the other hand, electrical street railway promoters are able to get everything they ask for in the way of money to finance their schemes. The official Receiver's opinion is that the directors were imprudent in embarking upon schemes "entirely beyond their means." There are many engineers who are anxious that gas-driven cars should have every opportunity of proving of what they are capable, and from that point of view the mistake is the more regrettable.

New Dry Docks for San Francisco.

A dispatch from San Francisco states that a new dry dock is to be built at Hunters' Point in San Francisco Bay, at a cost of about $750,000. The dock is to be 750 ft. long, 80 ft. wide at the bottom and 124 ft. wide at the top, and will have 28 ft. of water over the sills at low tide.

Pullman and Wagner Improvements.

The Wagner Palace Car Co. will not enlarge the shops at East Buffalo, N. Y., as reported. Regarding the report that the Pullman Co. will build repair shops in Denver, Colo., we are told that officials have looked over the Union Pacific shop plant at Denver, and the company has under consideration a proposition to utilize part of it, but plans have not yet taken definite shape.

Lehigh Valley Shops.

The car shop of the Lehigh Valley at South Easton, Pa., has been closed, and the work heretofore done in this shop will be done at Sayre, to which place all material has been transferred. The company has built at Sayre, during the present year, the following new buildings: Cabinet shop, 60 x 200 ft.; freight car repair shop, 140 x 204 ft.; paint shop, 224 x 240 ft.; blacksmith shop, 75 x 200 ft.; paint store house, 20 x 50 ft.; power house, 40 x 180 ft.; extension to machine shop, 124 x 144 ft.; remodeled old blacksmith shop for upholstering shop, 50 x 200 ft., and built two new electric transfer tables. All passenger and freight car work for the entire Lehigh Valley system is to be done at Sayre.

The Republic Iron & Steel Co.

James C. Corns has resigned as Third Vice-President of the Republic Iron & Steel Co., and has been succeeded by Alex. W. Thompson of New Castle, Pa. Mr. Corns remains District Manager of the Northern District. Philip Jones, recently of Lisbon, O., has succeeded Herman Joseph as Superintendent of the mills at New Albany, Ind.

The Republic Iron & Steel Co. is installing in the Bessemer steel plant at the Brown-Bonnell Works, Youngstown, O., a great deal of labor saving machinery, and expects to have the plant in operation by March. An additional 25-ton open hearth furnace is being built to the open hearth plant at Minneapolis, to be ready by Feb. 1. It is the intention to build two additional blast furnaces at Thomas, Ala. On account of the inability to get blowing engines for anything like nearby delivery, the first furnace can hardly be in operation before some time next fall. The production of finished iron and steel from May to October, inclusive, was 388,994 tons. The production of muck bar from May to October, inclusive, was 218,411 tons, and of pig iron from May to October, inclusive, was 197,699 tons. The daily output of pig iron since Nov. 1 has been 1,200 tons. The output of the six furnaces taken over has largely increased over what they were making prior to the time they were taken, and are now making at the rate of over 400,000 tons per year.

Work on the Boston Elevated Structure.

One mile of the elevated structure on the Roxbury Division and a half mile on the Charleston Division have been completed. The work is done at night, when $\frac{1}{10}$ of a mile of structure is put up each night. A general notion of the appearance of structure may be obtained from the engraving in our issue of Nov. 24, page 805. The foundations on the Atlantic Avenue Division have been finished, which completes the entire pier foundation work of the elevated structure as originally proposed. The Lincoln wharf on Atlantic Avenue is now being filled in for the foundations of the large power house to work the elevated cars.

Grain Elevators Proposed at Montreal.

A press despatch from Montreal reports that the Harbor Commissioners of the port of Montreal have accepted a proposition made by Buffalo and Cleveland capitalists, represented by W. J. Connors, to build a large elevator and freight sheds, and 15 steam barges, with tows, all at a cost of $1,100,000. The syndicate agrees to bring 25,000,000 bushels of grain to Montreal next season and to increase this amount to 35,000,000 bushels or more in 1901. The Harbor Commissioners are to provide land for the proposed buildings.

Low Street Car Fares in Chicago.

The Receiver of the Calumet Electric Railway, Chicago, on December 1 made a rate of two rides for five cents between Sixty-third St. and Stony Island Ave., and South Chicago and Roby. Since the City bridge at Ninety-fifth St. broke down some months ago, the Calumet has been cut off from the use of about four miles of track and a ferry will be used until the bridge is replaced. The South Chicago City Railway refused to let the Calumet Electric use its bridge at Ninety-second St., and the reduced fare was made in consequence.

Chicago Notes.

In the United States Circuit Court at Chicago, Nov. 25, before Judge Kohlsaat, a jury gave a verdict in favor of the Pennsylvania Company for $2,792 damages against the city of Chicago for property of the railroad company which was destroyed during the strike in 1894. The trial of the case began Nov. 13, the railroad company asking for $30,000 damages. The suit was brought under the Illinois law which holds the city liable for three-quarters of the actual damages done by mobs. In a previous case (that of the Manhattan Cement Co.), to test the constitutionality of the law, the Supreme Court of the State decided that the law was constitutional. In the case here noted a large number of witnesses for the railroad company were examined. The city filed application for a new trial, and if it is not granted the case will be taken to the higher courts. This case is the first of about 50 similar suits which are pending against the city, the aggregate damages claimed being very large. (Apr. 14, p. 268.)

The Wisconsin Central's lease of terminal facilities at the Grand Central station expired Dec. 1 and, as the negotiations toward a renewal have so far been unsuccessful, the Chicago Terminal Transfer Co., which owns the station, announces that it will handle the Wisconsin Central trains to and from the city terminus of the Wisconsin Central at Central Ave. It is not yet announced what permanent arrangements the Wisconsin Central will make for terminal facilities, but it is understood that plans are under consideration and that the arrangement noted above is only temporary.

Lake Notes.

The barge George E. Hartnell took in a cargo of 5,000 tons of iron ore in 2½ hours at the Wisconsin Central docks at Ashland, Wis., last week.

On Dec. 1 it was reported that more than 140 vessels were detained at Sault Ste. Marie, Mich., owing to the stranding of the steamship Siemens, which blocked the channel.

The steamer Holdon at Chicago, Dec. 2, loaded 350,000 bushels of oats for Buffalo, which is said to be the largest number of bushels of grain ever carried out of a Lake Michigan port.

It is announced that on account of the great demand for iron ore, the Minnesota Steamship Co. will try the experiment of running its fleet of five large steamers during December, and, if possible, during January. As insurance expires Dec. 5, the vessels will run without insurance and without the help of lights, fog signals, etc., which the Government does not maintain on the lakes in winter.

LOCOMOTIVE BUILDING.

The Central of New Jersey is considering buying a number of new locomotives.

The Chicago & Eastern Illinois is preparing specifications for five or six passenger locomotives.

The Baldwin Locomotive Works are building one consolidation engine for the Calumet & Hecla Mining Co.

The Kansas City, Pittsburgh & Gulf is asking what deliveries can be made on from 10 to 20 locomotives.

We are officially informed that the Mineapolis, St. Paul & Sault Ste. Marie is not in the market for locomotives.

We understand that the Rutland has placed an order with the Schenectady Locomotive Works for four mogul engines.

It is reported that the Cleveland, Cincinnati, Chicago & St. Louis is in the market for a large number of engines, about 30.

We understand that the Pittsburgh & Lake Erie is building some locomotives at its own shops, but we have no official information.

The Kansas City, Fort Scott & Memphis recently placed an order for six locomotives with the Pittsburgh Locomotive & Car Works.

We understand that the Colorado Southern wants some locomotives, but that the purchase has not yet been authorized by the Directors.

The Chicago Great Western is considering some new locomotives, but we are officially informed that the number and type are not yet decided.

The Seaboard Air Line is in the market for 25 ten-wheel locomotives for freight service, 20 eight-wheel passenger locomotives and five six-wheel switchers.

We are officially informed that the Buffalo, Rochester & Pittsburgh has ordered 11 freight and four

passenger locomotives from the Brooks Locomotive Works, for delivery in May and June, 1900.

It has been reported recently that the Chesapeake & Ohio was in the market for a large number of locomotives, but we are officially informed that no move has yet been made toward buying any new locomotives.

The Southwestern Coal & Improvement Co., substantially identical with the Missouri, Kansas & Texas, has contracted with the Baldwin Locomotive Works for 25 engines, 23 of which are moguls and 2 consolidations.

Press dispatches state that J. P. Rogers, Superintendent of the White Pass & Yukon, has given out the statement that four new engines, two of which are compound and two simple, have been ordered for February delivery.

Last week we stated that the Baldwin Locomotive Works had received an order for 20 Class H-4 consolidation engines, omitting to give the name of the railroad. These engines are for the Pennsylvania Lines West of Pittsburgh.

The Richmond Locomotive & Machine Works have received an order from the Rio Grande Western for eight consolidation locomotives, with 22 in. x 28 in. cylinders. Four will have 56 in. drivers and will weigh 190,000 lbs., and the other four will have 51 in. drivers and will weigh 183,000 lbs.

We are officially informed that the report published recently in some of the railroad papers that the Grand Rapids & Indiana was in the market for six locomotives is not correct. This road has some locomotives under contract for delivery in January, 1900, but contemplates buying no additional engines.

Press dispatches state that the Fitchburg has ordered a total of 26 new engines from the Baldwin Locomotive Works, Schenectady Locomotive Works and the Manchester Locomotive Works. On Nov. 24 we noted the report that the road had placed an order with the Baldwin Works for eight and on Sept. 15 we noted an order for six placed with the Manchester Works.

In our last issue we stated that the Southern is in the market for a number of locomotives. Bids have been asked on four 10-wheel engines with 20 in. x 26 in. cylinders, four of the same type with 21 in. x 28 in. cylinders, and 25 consolidation engines with 21 in. x 28 in. cylinders for use on the Southern, and two 10-wheel engines with 19 in. x 26 in. cylinders and six consolidations with 20 in. x 26 in. cylinders for the Alabama Great Southern.

The Kansas City, Fort Scott & Memphis ordered, November 25, from the Pittsburgh Locomotive & Car Works, six simple consolidation locomotives for delivery in June and July 1900. They will have 21 in. by 30 in. cylinders, 57 in. in diam. They will weigh 180,000 lbs., of which 160,000 will be on the drivers, and will have Belpaire boilers with working steam pressure of 200 lbs.; 345 iron tubes 2 in. in outside diam. and 13 ft. 5 in. long; fireboxes of steel 120 in. long and 41 in. wide; tank capacity for water, 5,000 gals. and for coal, 10 tons. Westinghouse air brakes will be used. These engines are designed for use in the Ozark District where there are numerous 80-ft. grades.

The five locomotives being built for the Lehigh Valley by the Baldwin Locomotive Works, referred to Nov. 24, will be of the Vauclain compound type, with 18 in. and 30 in. x 30 in. cylinders; 55 in. driving wheels; boilers with wide fireboxes; 511 charcoal iron tubes, 2 in. in diam. and 14 ft. 7¾ in. long; working steam pressure, 200 lbs.; fireboxes, of Carbon steel, 10 ft. long and 9 ft. wide; and a tender capacity for 7,000 gals. of water and nine tons of coal. The specifications call for Westinghouse air brakes, Snow bell ringers, metallic brakebeams, Christie brake shoes, Gould couplers, Glazier headlights, Metropolitan injectors, Consolidated safety valves, Leach sanding devices, Detroit lubricators, Ashcroft steam gages, Latrobe driving wheel tires and McKee-Fuller truck and tender wheels.

The three engines referred to last week as being built by the Pittsburgh Locomotive & Car Works for the Ohio River are eight-wheel passenger, weighing 88,000 lbs., with 17 in. x 24 in. cylinders, 62 in. driving wheels, wagon top type of boilers with a working steam pressure of 160 lbs., and a tender capacity for 3,500 gals. of water and seven tons of coal. The specifications call for Westinghouse brakes, Pyle-National electric headlights, Monitor injectors, Leach sanding devices, Nathan lubricators and Consolidated steam heat equipment. One of the engines has been delivered and the two others will be shipped Dec. 14 and 24 respectively.

On Nov. 24 we noted that the Interoceanic of Mexico had ordered two locomotives from the Baldwin Locomotive Works. These locomotives are to be Vauclain compound consolidation engines of 3 ft. gage, with a total weight 91,000 lbs., of which 81,500 lbs. will be on the drivers. The cylinders will be 12 in. by 20 in. by 20 in. and the drivers 38 in. in diam. The boilers will be of the straight top type with radial stays and working steam pressure of 180 lbs. There will be 179 iron tubes 2 in. in outside diameter and 14 ft. 6 in. long. The fireboxes will be of homogeneous cast steel 54 5/16 in. long and 44⅞ in. wide, and tank capacity for water will be 3,000 gals. The equipment specified includes Westinghouse air brakes, Cambria steel axles, Coffin process, Sellers injectors, U. S. Metallic piston and valve rod packing, Richardson safety valves, French springs and cast steel wheel centers.

In our issue of Dec. 1 we noted that the Chicago, Indianapolis & Louisville had ordered two passenger locomotives from the Brooks Locomotive Works. They will be simple 10-wheel locomotives for delivery in March and April, 1900. They will have cylinders 20 in. by 26 in., drivers 69 in. in diam., and a total weight of 153,000 lbs., of which 118,000 lbs. will be on the drivers. The boilers will be of the Belpaire type with working steam pressure of 210 lbs. There will be 340 charcoal iron tubes 2 in. in outside diameter and about 13 ft. 2¼ in. long. The fireboxes will be of Carnegie homogeneous steel, 114 in. long and 42 in. wide, and the tank capacity for water will be 5,000 gals. The special equipment specified includes Westinghouse air brakes, Coffin toughened steel axles, Gollmar bell ringers, Trojan couplers, U. S. Metallic piston and valve rod packings, Consolidated and Kunkle safety valves, Leach sanding devices, Detroit sight feed lubricators with Tippett attachments, French springs, Consolidated steam heating equipment, piston valves, Johns sectional boiler lagging, Leeds pilots and Chicago, Indianapolis & Louisville standard brake beams.

The Illinois Central has ordered seven passenger engines from the Rogers Locomotive Co. instead of six, as noted in our issue of last week. The 10 six-wheel switching engines ordered from the Baldwin Locomotive Works will weigh 118,900 lbs., will have 19 in. x 26 in. cylinders, 51 in. in diam. drivers, straight top type boilers, steam pressure 180 lbs., 220 tubes 2 in. in diam. and 11 ft. 7 1/16 in. long, Carbon steel fireboxes, 112 in. long by 33¾ in. wide; tank capacity, 2,500 gals .of water and four tons of coal; Westinghouse train and driver brakes, iron axles, Heginbottom bell ringers, Monarch brake beams, cast iron brake shoes, McKeen couplers, part United States and part Jerome metallic piston rod and valve packings, Ashton valves and gages, Nathan lubricators, Leach sanding devices, French springs, cast steel wheel centers. In addition to the special equipment for freight and passenger engines noted last week, the passenger engines will have Gold heating system and part will have Sellers injectors and the balance those made by another company. Half the freight engines will have Nathan injectors and half Ohio injectors. The coal capacity of tenders will be 10 tons.

The Pittsburgh Locomotive & Car Works are building 10 simple consolidation and 4 six-wheel switching locomotives for the Cincinnati, New Orleans & Texas Pacific. They will have 20 in. x 24 in. cylinders, 52 in. in diam. drivers, will weigh 120,000 lbs., with 106,000 lbs. on drivers. They will have straight top boilers, 60 in. in diam., working steam pressure 180 lbs., 240 iron tubes 2 in. in diam. and 13 ft. 5 in. long, Carbon steel fireboxes 9 ft. long, 2 ft. 9 in. wide; tank capacity for water, 4,000 gals, and for coal, eight tons. The switching engines are for December and April delivery, and will weigh 119,000 lbs., and will have 19 in. x 26 in. cylinders, 50 in. in diam. drivers, straight top type boilers, steam pressure 180 lbs., 271 iron tubes 2 in. in diam.; fireboxes, 96 in. x 33 in.; tank capacity for water, 3,500 gals. and for coal, six tons. The fireboxes and boilers will be of Carbon steel. All the locomotives are to have Westinghouse air brakes, Coffin steel axles, Sterlingworth brake beams, Diamond S brake shoes, Janney couplers, Monitor injectors, U. S. Metallic packings, Coale safety valves, Leach sanding devices, Nathan lubricators, French springs, Ashcroft gages, cast steel wheel centers and Latrobe tires.

Last week we gave the specifications for the six shifting and eight passenger engines ordered by the Boston & Maine from the Manchester Locomotive Works. The following covers the five 10-wheel passenger and six 10-wheel freight locomotives ordered from the Rhode Island Locomotive Works. The engines are for May and June, 1900, delivery. The passenger engines will weigh 135,000 lbs., with 102,000 lbs. on the driving wheels, and have 19 in. x 24 in. cylinders; 69 in. driving wheels; radial stay, extended wagon top type boilers with 267 Syracuse iron tubes 2 in. in diam. and 13 ft. 7½ in. long, and a working steam pressure of 185 lbs.; fireboxes, of Carbon steel, 96 in. long and 41⅝ in. wide; and a tender capacity for 4,000 gals. of water and four tons of coal. The freight engines will weigh 134,000 lbs., with 101,000 lbs. on the driving wheels, and have 19 in. x 26 in. cylinders; 63 in. driving wheels; a working steam pressure of 180 lbs. and a tender capacity for 4,000 gals. of water and 7 tons of coal. In other respects the dimensions as given for the passenger engines are the same for the freight. The specifications for both types call for Westinghouse air brakes, Midvale axles, Sterlingworth brakebeams, Diamond S brake shoes, Gould couplers, 16 in. circular headlights, metallic piston and valve rod packings, Ashton safety valves, Shea sanding devices, Nathan lubricators, French springs, Crosby steam gages, Consolidated steam heat equipment, Midvale driving wheel tires and Standard truck wheel tires. The passenger engines will have Standard and the freight engines chilled iron tender wheels.

CAR BUILDING.

The Georgia & Alabama will build 300 flat cars at its Americus shops.

Newspapers state that the Fitchburg has ordered 12 new caboose cars.

The Mobile & Ohio will build the 1,000 box cars noted in our issue of Nov. 3.

The Louisville, Evansville & St. Louis Consolidated is asking bids on 200 box cars.

The Mt. Vernon Car Mfg. Co. has an order for one freight car for the Carson & Colorado.

The Southern Pacific has ordered 500 stock cars from the American Car & Foundry Co.

The American Car & Foundry Co. is building nine freight cars for the Companie Minera de Pinoles.

It is rumored that the Oregon Short Line is considering several hundred cars, but we have nothing official.

It is rumored that the Chicago & Alton is considering a large number of cars, but we have nothing official.

The cars wanted by the Southern are 2,500 freight, 12 eight-wheel passenger and 18 twelve-wheel passenger.

We are informed that the Rutland has ordered six vestibule passenger cars from Pullman's Palace Car Co.

It is rumored that the Delaware, Lackawanna & Western has asked bids on 3,500 coal cars. We have nothing official.

The Barrett Mfg. Co. has ordered the 20 tank cars noted in our issue of Nov. 10 from the American Car & Foundry Co.

We understand that the Colorado Southern wants some cars, but that the purchase has not yet been authorized by the Directors.

It is reported, but not officially, that the National Rolling Stock Co. has ordered 25 flat cars from the American Car & Foundry Co.

It is reported that the Colorado Midland is considering ordering several hundred freight cars, but we have no official information.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 600 box cars of 60,000 lbs. capacity from the American Car & Foundry Co.

We are informed, but not officially, that the Philadelphia & Reading is preparing specifications and getting prices on a large number of cars.

The American Car & Foundry Co. has received an order from the Wheeling & Lake Erie for 250 box cars. This is in addition to the 500 cars recently noted.

The Delaware & Hudson has placed an order with the American Car & Foundry Co. for 1,000 box cars and we are informed that the road is in the market for 1,000 coal cars.

In our issue of Nov. 24 we noted that the White Pass & Yukon was building 100 cars at its own shops. We now understand that the number is 130 in all, 50 box, 30 stock and 50 flat cars.

The 500 cars being built for the Pennsylvania by the Erie Car Works, as stated last week, will be Class G K gondolas with a capacity for 80,000 lbs. They will be equipped with Westinghouse air brakes and Janney couplers.

Last week we noted an order given by the Lehigh Valley to the American Car & Foundry Co. for 31 caboose and 25 poultry cars. The former will be L. V. standard four-wheel, gig top cars, with hand brakes, Graham draft rigging and L. V. standard journal boxes with pressed steel lids and 33 in. chilled cast iron wheels. The poultry cars will be of 60,000 lbs. capacity, measure 36 ft. 2¼ in. long, 9 ft. 2¼ in. wide and 8 ft. 10 in. high, inside, and will be equipped with metallic brakebeams, Christie brake shoes, Westinghouse air brakes, M. C. B. automatic couplers, L. V. special draft rigging, McCord journal boxes and journal box lids, Fox trucks, L. V. No. 1 chilled cast iron wheels and L. V. standard axles, bolsters, brasses and paint.

BRIDGE BUILDING.

ALEXIS, MICH.—The new electric railroad building from Toledo, O., to Detroit, Mich., will need a bridge where it crosses the Michigan Central, Lake Shore and other railroads at this place.

BLOOMFIELD, N. J.—Plans have been prepared by the Delaware, Lackawanna & Western for raising and double-tracking the Morris & Essex branch between Bloomfield and Montclair. The plans provide for several bridges and a new passenger station at Bloomfield, but no work will be done this year.

BOSTON, MASS.—The Board of Engineers appointed by the Government gave a hearing on the first inst. on the proposed bridge over Fort Point Channel from the Cove St. extension.

BRANTFORD, ONT.—The Grand Trunk Ry. proposes to add a span to the bridge across the Grand River at this place. The length is not finally determined. The object is to give greater waterway in times of flood.

CARBONDALE, ILL.—Regarding the report that the Illinois Central will rebuild many bridges between Carbondale and Cairo, an officer of that company writes that the company has not yet made any arrangements for bridge work for next year.

CEDAR RAPIDS, IA.—Bids will be wanted in about 30 days by the Public Improvement Committee for a five-span steel Pratt truss bridge, each span 114 ft. long, to replace the Ave. B structure over the Cedar River. G. Merrideth, City Eng.

CHATTANOOGA, TENN.—The Nashville, Chattanooga & St. Louis Ry. Co. has offered to build the viaduct over the right of way on Market St. A structure at this place will probably cost $50,000.

CHEYENNE, WYO.—The new bridge proposed over Dale Creek several miles west of Sherman by the Union Pacific RR., will have 14 spans 40 ft. in length, and steel towers.

CLEVES, O.—County Engineer Krug has been ordered by the Commissioners to make plans and estimates for a new plate girder bridge over Dry Fork Creek on the Harrison Road. The bridge is to be 20 ft. wide and accommodate the Cincinnati, Lawrenceburg & Aurora Electric RR., which agrees to pay $3,500 toward the cost.

DARBY, PA.—The bridge proposed over Cobbs Creek at Thomas Ave., in Yeadon Township, will cost about $10,000. The County Commissioners are considering the matter.

DAYTON, O.—An ordinance granted the Dayton & Germantown Traction Co. stipulates that the road shall build a steel bridge in Lehman St., over the canal.

DELPHI, N. Y.—A suspension bridge over Delaware Ave. to the fair grounds is proposed at a cost of $70,000.

DENVER, COLO.—The County Commissioners have authorized the building of a bridge over Big Walnut Creek at the crossing of Broad St. extension, to cost $50,000.

ELGIN, ILL.—Plans, specifications and proposals will be received at the Mayor's office, Dec. 15, for a bridge over Fox River on Chicago St., consisting of three equal girder steel spans, 92 ft. long; total length between shore abutments, 270.6 ft.; 66 ft. wide with two 12-ft. sidewalks. Also for a bridge over Fox River at National St., consisting of three low truss riveted steel spans of 102½ ft. each, with 18-ft. roadway, and two 6-ft. sidewalks. Bids will also be received on stone or concrete foundations. Arwin E. Price, Mayor.

GAINESVILLE, TEX.—A bridge is proposed across the Red River in Cooke County.

GLASSPORT, PA.—Wm. Bell, Times Bldg., Pittsburgh, will receive bids after Jan. 1 for a combination suspension and stiffening truss bridge 1,200 ft. long, to be built over the Monongahela River for the Glassport Bridge Co. The estimated cost is $125,000.

HACKENSACK, N. J.—The Bergen County Traction Co., with office at the foot of West 130th St., New York, has been granted permission to build an iron bridge about 400 ft. long over the Hackensack River. The plans are now being made. Wm. N. Barrows, Secretary.

HONESDALE, PA.—The Grand Jury has approved the report of viewers for a new bridge at the glass factory in Texas Township.

JOPLIN, MO.—Reports state that the city will build two bridges across Turkey Creek.

KINGSTON, TENN.—Local reports state that it has been voted to issue $25,000 of bonds toward building the bridge proposed by the Kingston Bridge Terminal Co. over Clinch River.

LA CROSSE, WIS.—Bonds for $42,000, will be sold in January for bridge-work. L. W. Gosnell, City Clerk. La Cross County recently sold $5,000 of bonds for similar work.

LOCKPORT, N. Y.—Bids are wanted by the Department of Public Works at Albany, N. Y., until Dec. 13, for building a steel lift bridge over the Erie Canal at Chapel St., Lockport, as advertised in the Railroad Gazette.

MANITOU, MAN.—James E. Gayton, Clerk of the Municipality of Pembina, will receive bids until Dec. 22 for the superstructure of steel truss bridges 75 ft. and 135 ft. long, to cost respectively about $4,000 and $5,000. Both bridges will cross the Pembina River. James Wilcox and Lamb & Mazelfield have the contracts for the foundations of both structures.

McCONNELLSBURG, PA.—The County Commissioners have under consideration the proposed bridge (100 ft. long) over Brush Creek, near Crystal Springs in Brush Creek Township.

MILWAUKEE, WIS.—The matter of a bridge across the Milwaukee River connecting Cedar and Biddle Sts., is again before the City Council.

NEW YORK, N. Y.—The Board of Public Improvements Dec. 1 approved the plans for the two projected bridges over the East River, as prepared by Bridge Commissioner Shea. One bridge is to extend from Pike slip, Manhattan, to Washington St., Brooklyn, and the other is to cross the East River at Blackwell's Island, from Sixtieth St., Manhattan, to Long Island City. It is estimated that the bridge leading to Washington St., Brooklyn, will cost $10,865,000 if a suspension bridge, and $9,552,000 if a cantilever bridge. The total cost, including the approaches, is estimated at $17,146,400 for a suspension bridge and $15,883,400 for a cantilever bridge.

The Council has adopted a resolution authorizing the issue of $4,000,000 in bonds for the new East River Bridge. This makes a total of $8,000,000 appropriated for this purpose, and it is estimated that nearly as much more will be needed to finish the structure. The preliminary plans for both bridges have been made.

John L. Shea, Commissioner of Bridges, will receive separate bids until 3 p. m., Dec. 14, for placing electrical equipment for the handling of Carroll St. bridge and the Washington Ave. bridge, Borough of Brooklyn.

OROVILLE, CAL.—It is estimated that the bridge over the Sacramento River near Chico can be repaired for $4,559. (Oct. 27, p. 751.)

OZARK, ARK.—Bids are wanted until Dec. 20 for the 270-ft. steel bridge over Big Mulberry Creek. It will have two spans—one 150 ft. and the other 120 ft. long, with tubular steel piers, with 20 ft. of approach at one end and 90 ft. at the other. Address John T. Greer, County Commissioner. (Nov. 3, p. 767.)

PHILADELPHIA, PA.—An attempt is again being made to have the bridge built over the Pennsylvania and the Philadelphia & Reading tracks on the line of Thirty-third St., between Jefferson and Girard Aves. The abutments and piers for this bridge were built several years ago. In October of 1898 it was estimated that $40,000 would finish the work.

PITTSBURGH, PA.—The ordinance authorizing an appropriation of $520,000 for bridges has been signed by Mayor W. J. Diehl.

PONTIAC, ILL.—Bids are wanted Dec. 12, by Fred. G. White, City Clerk, for rebuilding the Vermillion St. bridge.

PRINCE, W. VA.—The Chesapeake & Ohio Ry. has let a contract to the Pencoyd Iron Works for a bridge 830 ft. long across New River, on the extension to Beckley, W. Va.

REDDING, CAL.—The Board of Supervisors have accepted the plans and specifications prepared by County Commissioner Baltzell for a three-span Howe truss bridge across the Sacramento River below the mouth of Spring Creek. The County Clerk will receive bids on the structure Jan. 10, 1900. A list of bids received on a steel bridge at this point was given in this column Sept. 22, p. 665.

The people of South Park have petitioned for a bridge across Spring Creek. A. J. Dryman, County Clerk.

ROCHESTER, N. Y.—The bridge proposed across the Lower Genesee River at the intersection of Ridge Road, to connect the town of Greece with Irondequoit, will probably be a steel cantilever bridge 50 ft. wide, and cost about $185,000, according to the estimates made by the Groton Bridge & Manufacturing Co. of Groton, N. Y. Charles L. Yates is chairman of the committee.

ROCKFORD, ILL.—A new iron bridge across Kents Creek at West State St. is in contemplation. Edward Main, City Engineer.

SAGINAW, MICH.—We are told that plans for an iron bridge to cost about $150,000 will be ready early in January, when bids will be wanted for the work.

SALEM, MASS.—The County Commissioners have been petitioned to widen and rebuild the Forest River bridge between Salem and Beverly, according to report.

SENECA FALLS, N. Y.—We are told that plans are now being prepared preliminary to advertising for bids for the steel bridge to be built over the Seneca River and Canal at Rumsey St., by the Department of Public Works. There will be two 120 ft. riveted through spans and one 80 ft. riveted half through span. Edward A. Bond, State Engineer, Albany, N. Y.

SMITHTON, PA.—Bids will be received until noon of Dec. 14, by the Commissioners of Westmoreland County, for a steel bridge 552 ft. long, to cross the Youghiogheny River and the Pittsburgh & Lake Erie RR. The estimated cost is $40,000.

SPOKANE, WASH.—The Great Northern proposes to build two steel bridges in place of the present Washington St. bridge. On a new right of way all street crossings will be above or under grade.

SYRACUSE, N. Y.—The Department of Public Works at Albany will receive bids until Dec. 13 for building a lift bridge over the Erie Canal at Catherine and Almond Sts., Syracuse, as advertised in the Railroad Gazette.

THREE RIVERS, QUE.—The municipality has applied to the Provincial Government for permission to issue bonds to rebuild the St. Maurice River bridge. (Nov. 17, p. 798.)

TOPEKA, KAN.—The Missouri Valley Bridge & Iron Co. has the contract for two bridges over the Kansas River, each to cost $12,000. (Oct. 13, p. 717.)

TURNERS FALLS, MASS.—The County Commissioners last week ordered that the New York, New Haven & Hartford build a steel foot-bridge on Avenue A in Turners Falls, to be finished May 1, 1900. (Oct. 20, p. 734.)

UKIAH, CAL.—The Supervisors rejected the bids received Nov. 24 for building a bridge across the Garcia River.

VANCOUVER, B. C.—The Canadian Pacific has asked the City Council to build a bridge over the yard tracks from Abbott to Carrol Sts.

WAYCROSS, GA.—Bids are wanted Dec. 16, according to report, for the proposed bridge across Kettle Creek, which will be 320 ft. long; also for a 450 ft. extension to the iron bridge over Satilla River, and for a 500 ft. bridge. (Oct. 20, p. 734.)

WELLINGTON, KAN.—Reports state that the County Commissioners will soon receive bids for three steel bridges and one pile bridge.

WELLSBORO, PA.—The Wrought Iron Bridge Co. of Canton, O., has the contract for the steel bridge, 119 ft. long, with 16 ft. roadway. (Oct. 20, p. 734.)

WOODLAND, CAL.—The Board of Supervisors of Yolo and Solano counties have decided to build two bridges over Putah Creek, each bridge to cost $10,000. One bridge at the Stevenson's site will be built during this fiscal year, and the other at the Ager-Curry site during the next year. W. O. Russell, Secretary.

Other Structures.

CALHOUN, TENN.—Local reports state that the Southern Ry. proposes to build a new station at this place, if the citizens will offer suitable ground. Five sites have been offered.

CHICAGO, ILL.—It is reported that plans for a new passenger station for the Lake Shore & Michigan Southern and the Chicago, Rock Island & Pacific are under consideration in connection with the elevation of the tracks of those roads, which is now being considered by the City Council. This station is on the line of the Union Elevated Loop and it is said the new station will be on a level with the Loop structure.

The Stockham Mfg. Co., 2577-2601 Grand Ave., will build a brass and iron foundry 150 x 300 ft. and 32 ft. high, to cost $50,000, including equipment.

W. P. Doerr has bought a lot fronting 87.7 ft. on Midway Plaisance and 158 ft. on Kimbark Ave., and excavating has begun for an apartment house to be built at once after plans of J. F. & J. P. Doerr. The house will cost about $75,000.

COLLINGWOOD, ONT.—The people have decided to grant a bonus of $50,000 for the establishment of a new shipyard, which is being promoted by Capt. Alexander McDougall of Duluth and Messrs. Thomas and J. J. Long and Charles Cameron of Collingwood. In view of large contemplated expenditures to be made by the Canadian Government the location is considered a good one and it is reported that work on the shipyard will begin at once. (Nov. 24, p. 814.)

DENVER, COLO.—The Colorado & Southern will build and equip new shops at Denver on ground already selected.

DETROIT, MICH.—The Michigan Heater Co. has sold its plant to the Detroit Galvanizing & Sheet Metal Works, and has secured a new site upon which buildings to cost about $20,000 will be built.

DIXON, ILL.—Charles E. Brush of Chicago was the successful architect in a competition for the best design for the Lee County court-house. It will be three stories high with basement, and will be of fireproof construction, to cost about $100,000.

HOCHELAGA, QUE.—The Canadian Pacific Ry. Co. have awarded the contract for building an addition to the foundry buildings at Hochelaga, Que., to J. P. O'Leary.

HOT SPRINGS, ARK.—The Little Rock & Hot Springs Western RR. is about to let a contract for a new station, roundhouse, water tank, freight depot and other buildings for Hot Springs. The passenger station will be on Market St., between Elm and Valley Sts. The plans were made by Mr. S. P. Van Patten.

JERSEY CITY, N. J.—The Babcock & Wilcox Co. has broken ground for the five projected buildings at Bayonne, all of which will be of iron framework with iron roofs.

MONTREAL, QUE.—The Canadian Atlantic Ry. has applied to the Montreal Harbor Commissioners for permission to build grain elevators.

MONTEREY, MEX.—Companie Minera y Afmadora will build a lead refinery and by-product building 140 x 200 ft., with a steel frame and floors and with modern furnaces and equipment. A. F. Schneider is Engineer.

NASHVILLE, TENN.—The five-story elevator of B. S. Rhea & Co., on the river front, and five cars on the Louisville & Nashville, also two spans of the railroad bridge, were destroyed by fire Nov. 25.

NEW BERNE, N. C.—The Atlantic & North Carolina RR. will make improvements at this place which include building a fertilizer warehouse, a freight station 80 x 220 ft., for which the contract has been let, a paint and carpenter shop.

NEW ORLEANS, LA.—Eastwick Engineering Co. have secured the contract for the new carpenter and paint shop for the New Orleans & Carrollton Railroad.

NEW YORK, N. Y.—Plans have been filed with the Building Department for a building by W. W. Astor on the site of the Star Theatre, at Broadway and Thirteenth St. It is to be of brick and stone, eight stories high, and will cost about $400,000. Clinton Russell is the architect.

A six-story brick and stone telephone exchange and office building, 100 x 53 ft., will be built by the New York Telephone Co., at the corner of Irving Place and Eighteenth St., at a cost of about $150,000. C. L. W. Eidlitz is the architect.

The Police Commissioners propose to build five new stations next year. An appropriation of $475,000 has been made for this purpose.

An apartment house at 137-139 W. Forty-fifth St. will be built at a cost of $130,000, by W. H. Stearns of 156 Fifth Ave. C. A. Rich is the architect.

Mr. Geo. B. Post has been selected as architect for the building for the New York Stock Exchange on Broad St.

Plans have been filed by Benjamin Weil of the Borough of Queens, for a summer hotel at Arverne, to be 70 ft. wide, 166 ft. long and five stories in height.

The Commissioners of Docks and Ferries will have plans and specifications prepared for a new pier at the foot of Pike St., East River, to be known as Pier 17.

The buildings at the southwest corner of Hudson and Vestry Sts. and at 385 and 387 Washington St. have been torn down to make way for a new 7-story warehouse to bebuilt for W. C. Dewey.

A seven-story brick and stone flat will be built at St. Nicholas Ave. and 113th St., at an estimated cost of $140,000, by Gundlach & Koch, 204 East Sixteenth St.

OMAHA, NEB.—The new union passenger station of the Chicago & Northwestern and Union Pacific roads in Omaha has been opened for business.

PHILADELPHIA, PA.—Chas. Craig has the contract to build the foundations for the foundry building at the southeast corner of Thirteenth St. and Gray's Ferry Ave., for the Schuylkill Iron & Steel Co. The plans for the superstructure are not completed.

The University of Pennsylvania, Nov. 28, announced a donation of $250,000 toward building a physical laboratory. The new laboratory will be built adjoining the chemical laboratory.

Macey, Henderson & Co., contractors, are asking bids for a one-story brick and iron building, 120 x 126 ft., for the Electric Storage Battery Co., at Nineteenth St. and Alleghany Ave.

Plans are being made by Harry B. Shoemaker & Co. for a large apartment house which will have a steel skeleton. The building is estimated to cost about $400,000.

SAN FRANCISCO, CAL.—Reports state that estimates for the improvements at Angel Island have been made. They are for a station, iron pier and floating disinfecting plant, the total cost of which will be about $100,000.

SAVANNAH, GA.—Preliminary plans for a new station to be used by the Southern Ry., the Plant System and the Seaboard Air Line, have been made by the Georgia Construction Co. of Savannah. The building will be L shape, fronting 267 ft. on West Broad St., and will be about 966 ft. deep. The floor space of the main waiting room will be 5,000 sq. ft. There are separate waiting rooms for colored people. The second story will be used for offices. It is proposed that the main building be built of brick and the train shed of wood, with metallic roof and that the cost of the building and shed be not more than $150,000.

PROVIDENCE, R. I.—The Clyde Steamship Co. has given a contract to the Berlin Iron Bridge Co. for a pier shed and dock at Providence. The building will be 40 ft. wide and 600 ft. long.

QUINCY, MASS.—A new station will be built by the New York, New Haven & Hartford in Quincy. Work will be begun in the spring.

SEATTLE, WASH.—Plans are being made by the Seattle & International Ry. Co. for a 500-ft. wharf at Smithcove or at North Seattle.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Atlantic Coast Line.—Semi-annual, 3 per cent.
Boston & Lowell.—Four per cent., payable Jan. 1.
Boston, Revere Beach & Lynn.—Semi-annual, 1 per cent., payable Jan. 1.
Chicago & Eastern Illinois.—Quarterly, preferred, 1½ per cent.; semi-annual, common, 2 per cent., payable Jan. 2.
Little Miami.—Quarterly, 2¼ per cent., payable Dec. 11.
Philadelphia, Wilmington & Baltimore.—Semi-annual, 4 per cent., payable Jan. 2.
Richmond, Fredericksburg & Potomac.—Semi-annual, 3 per cent., payable Jan. 1.
Wilson & Summerton.—Six per cent.

Western Society of Engineers.

Mr. G. B. Springer, Civil Engineer of the Chicago Edison Company, read a paper before the Western Society of Engineers, Wednesday evening, December 6, entitled, "Electrical Underground Construction." The paper was illustrated by lantern slides and exhibits of materials used in such work.

American Society of Civil Engineers.

The fifty-seventh annual meeting of the American Society of Civil Engineers will be held in New York City, Wednesday and Thursday, Jan. 17th and 18th, beginning at 10 o'clock Wednesday morning. There will be a reception on either Wednesday or Thursday evening, and probably the second day of the meeting will be devoted to an excursion.

St. Louis Railway Club.

At the Nov. 10 meeting of the club, Mr. S. M. Dolan of the Wiggins-Ferry Co. read a paper entitled "Conducting a Car Department at a Large Terminal." The program for the December 8 meeting of the St. Louis Railway Club includes a paper entitled "The American Technical School and Its Relation to Railroads," by Prof. L. P. Breckenridge, of the University of Illinois; a discussion of Mr. S. M. Dolan's paper, read at the previous meeting, "A Car Department at a Large Terminal," and topics presented through the "Question Box." In the evening an entertainment will be provided at the Southern Hotel, this being the third annual meeting.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. E. V. Holcombe, Superintendent of Sleeping and Dining Cars, Great Northern Ry., at St. Paul, died suddenly in the street in that city Nov. 26 of heart disease. He was born in Cincinnati, O., in 1834, and was formerly a steamboat captain on the Mississippi River.

—Col. George R. Davis, who was Director-General of the World's Fair at Chicago in 1893, died at his home in that city Nov. 25 of heart disease, from which he had suffered for many years. Mr. Davis was born in Palmer, Mass., Jan. 3, 1840, and studied law in that State. He served in the army during the civil war, at the close of which he became one of Gen. Sheridan's staff and was made Superintendent of Railroad, River and Ocean Transportation for the Department of the Gulf. In 1871 he resigned from the army and went into business at Chicago.

—Mr. F. H. Clark, Chief Draftsman of the Motive Power Department of the Chicago, Burlington & Quincy, has been appointed Mechanical Engineer of that road from Dec. 1. Mr. Clark graduated from the University of Illinois in 1890 as a mechanical engineer. For several years he was engaged in consulting engineering work in Chicago as assistant to the late David L. Barnes and was also one of the editorial staff of the Railroad Gazette. In 1894 he accepted the position of Chief Draftsman of the Motive Power Department of the Chicago, Burlington & Quincy.

—As a good many of our readers have known, Mr. S. P. Bush, Superintendent of Motive Power of the Pennsylvania Lines, Southwest System, has been for some weeks talked of as the successor of Mr. Barr on the Chicago, Milwaukee & St. Paul. We are now informed that the appointment has been made and that the change will probably take effect January 1st. This must be a serious loss to the Pennsylvania Company and an important gain for the St. Paul. Mr. Bush was born in 1863, and has made a very important place for himself in the railroad world and has gone well up to the first rank of motive power men. He is a Stevens Institute man and entered the service of the Pittsburgh, Cincinnati, Chicago & St. Louis Railway in 1884 and has worked his way up, always in the Pennsylvania service, to his present position. He has been a public-spirited and efficient worker in the councils of the Master Car Builders' and Master Mechanics' associations, where his opinions always command great respect.

—Mr. Frank Ellmaker, who was Superintendent of the Middle Division of the Pennsylvania Railroad in 1893-4, died at a hospital in Philadelphia, Nov. 28, at the age of 45. Mr. Ellmaker had been in poor health for a long time and he retired from active business about a year ago. Mr. Ellmaker was born at Gap, Pa., and after completing his technical course at college in 1875 he entered railroad service as a surveyor on various new railroads in Maine, Ohio and elsewhere, being at one time Chief Engineer of the Springfield (O.) Southern. He entered the service of the Pennsylvania in 1880 and was in the engineering department at Altoona and on the Philadelphia, Monongahela and New York divisions. In 1886 he was made Superintendent of the Belvidere Division and was successively Superintendent on the Northern Central, the Philadelphia & Erie and other divisions of the Pennsylvania, going to Harrisburg in 1893. In 1895 he resigned to become Superintendent of the Consolidated Traction Company of New Jersey, with headquarters at Newark, N. J. He remained in this place until his health failed, last year. Mr. Ellmaker was a member of the Presbyterian Church, and the tributes of friends and acquaintances to his high character are unusually hearty. His capability and sense of justice in business and his amiability in personal relations are everywhere spoken of in the highest terms.

—In the death of John I. Blair of Blairstown, N. J., there passes away a figure of striking interest in the railroad field. Had he lived until next August Mr. Blair would have been 98 years old. For several years past he has found it necessary to withdraw from active administration of his various properties. He began his career as a railroad builder in 1839, in a connecting link between Oswego, N. Y., and Ithaca. This line, with the Warren and other lines which he aided in building, was finally merged into the Delaware, Lackawanna & Western, in which he was an intimate associate with Samuel Sloan and a director at the time of his death. Altogether he has aided in the building of at least thirty railroads, prominent among which are sections of the Burlington, Cedar Rapids & Northern, the Union Pacific, the Chicago & Northwestern, the New York, Susquehanna & Western, the Bangor & Portland, the St. Louis & San Francisco, the Chicago, Iowa & Dakota and the Green Bay & Western. His estimate was that he had spent $26,000,000 in railroad building. Of this every dollar was advanced by himself or by friends, without putting a dollar's worth of stock on the market to raise money.

In connection with this railroad building Mr. Blair received numerous grants of public lands. On the Union Pacific he received a million acres; for finishing the Iowa Falls & Sioux City, 700,000 acres; for the Sioux City & Pacific and the line known as the Blair cut-off between the Chicago & Northwestern and the Union Pacific at Tremont, he received 640,000 acres. A railroad up the Niobrara Valley in Nebraska brought him 100,000 acres. In caring for this land he formed land companies which, under his direction, laid out sites for more than 100 flourishing cities and towns in the West. A favorite method in his railroad building was to take a road that had been partially completed, rebuild it entirely or in part, complete it and then sell or lease to a trunk line. The last railroad built by Mr. Blair was the Kansas City, Osceola & Southern, which was completed last year and leased to the St. Louis & San Francisco. Most of his enormous fortune, estimated all the way from $50,000,000 to $70,000,000, was accumulated in these operations of railroad building. At the time of his death he was a member of the Board of Managers of the Delaware, Lackawanna & Western and a director of the Chicago & Northwestern, the Bangor & Portland and the Mount Hope Mineral. He was also a director of the Sussex and President and director of the Warren, both lines of the Delaware, Lackawanna & Western. Earlier in his career he was director at different times of fully a score of principal and subordinate lines.

ELECTIONS AND APPOINTMENTS.

Allegheny Valley.—W. H. Barton has been appointed Trainmaster.

Atchison, Topeka & Santa Fe.—C. F. Ressignie, heretofore General Superintendent of the Gulf, Colorado & Santa Fe, has been appointed General Superintendent of the A., T. & S. F., with headquarters at Topeka, Kan. Appointment effective Jan. 1.

Atlanta & West Point.—G. F. Huggans, heretofore Resident Engineer, has been appointed Superintendent, succeeding P. T. Downs, resigned. D. C. Bachelor has been appointed Assistant Superintendent.

Baltimore & Ohio.—Winfield S. Haines has been appointed Division Master Mechanic, with headquarters at Newark, O., succeeding W. H. Harrison, Jr., resigned. Effective Dec. 1. S. B. Mason has been appointed Assistant to Mechanical Superintendent, with headquarters at Mt. Clare, Baltimore, Md. Effective Dec. 1.

Bernard **Ashby has been** appointed District Passenger Agent, with headquarters at Philadelphia, Pa., succeeding James Potter, resigned.

Cane Belt.—Charles Boedeker has been appointed General Freight and Passenger Agent, and F. J. Huey, Auditor, relieving Vice-President and General Manager W. T. Eldridge to this extent. L. E. Beadle has been appointed Superintendent, effective Dec. 1.

Central Vermont.—In our issue of Oct. 13 we announced the resignation of W. J. Robertson as Master Car Builder of the Central Vermont. Being somewhat premature, we retracted in our issue of Oct. 27 the original statement. An official circular has now been issued by E. H. Fitzhugh, Vice-President and General Manager, giving notice of Mr. Robertson's resignation. James Coleman has been appointed Master Car Builder to succeed Mr. Robertson.

Chattanooga & Durham.—H. T. Ellison has been appointed Master Mechanic, with headquarters at Chickamauga, Ga.

Chattahoochee & Gulf.—E. K. Lawrence has been appointed Superintendent of Construction, with headquarters at Columbia, Ala., of the C. & G., which is now building. (See RR. Construction column, Nov. 17, p. 800.)

Chattanooga, Augusta & Charleston Air Line.—The officers of this company, which is now building, are: President, E. R. Williams, of Richmond; Vice-President, J. U. Jackson, of Augusta; Secretary, Henry Buist, of Charleston, and Treasurer, R. Goodwyn Rhett, of Charleston. The Directors are G. W. Williams, Jr., C. Wulbern, R. Goodwyn Rhett, S. H. Wilson, W. B. Chisholm and W. M. Wallace, of Charleston; Charles S. Heard and J. U. Jackson, of Augusta; E. R. William and J. W. Travis, of Richmond, and W. B. S. Whaley, of Columbia. (See RR. Construction column, Oct. 13, p. 719.)

Chicago & Northwestern.—S. Sanborn, heretofore General Superintendent, has been appointed Assistant General Manager and R. H. Aishton has been appointed General Superintendent, with headquarters at Chicago, Ill., succeeding Mr. Sanborn. H. J. Slifer has been appointed Superintendent of the Iowa Division, with headquarters at Boone, Ia., succeeding Mr. Aishton, effective Dec. 1.

Chicago, Burlington & Quincy.—Mr. F. H. Clark, Chief Draftsman of the Motive Power Department, is appointed Mechanical Engineer and Mr. C. B. Young, Draftsman, is appointed Chief Draftsman. Effective Dec. 1.

Chicago, Milwaukee & St. Paul.—S. P. Bush has been appointed Superintendent Motive Power. (See E. & A., Nov. 24, p. 819.)

George G. Mason has been appointed Trainmaster, with headquarters at Mason City, Ia., succeeding B. F. Van Vliet.

Cleveland & Marietta.—L. Ohliger has been appointed Superintendent.

Fitchburg.—The Fitchburg Railroad will hereafter be operated in two divisions, to be known as the Eastern Division and the Western Division. The division line will be at the westerly yard limit board of the Greenfield yard. The jurisdiction of M. P. Snyder has been extended to cover the new Western Division, J. R. Hartwell's division will be known as the Eastern Division, and is reduced correspondingly. Effective Dec. 1.

Floride Central & Peninsular.—Cecil Gabbett, Vice-President and General Manager of the Georgia & Alabama, will assume charge of the operation of the Northern Division of the F. C. & P., extending between Jacksonville, Fla., and Columbia, S. C., with headquarters at Savannah, Ga. Effective Dec. 1.

Great Northern.—P. T. Downs has been appointed Assistant General Superintendent of the Western District, succeeding C. Shields, resigned. Effective, Dec. 1.

Illinois Central.—C. C. Cameron has been appointed Assistant General Freight Agent, with headquarters at Louisville, Ky., of the I. C., and the Yazoo & Mississippi Valley. Effective Dec. 1.

W. J. McLean, heretofore General Passenger Agent of the St. Louis, Peoria & Northern, has been appointed General Passenger Agent of the I. C.

Jackson, Lansing & Saginaw.—A. J. Burt has been appointed Secretary, succeeding O. M. Barnes, deceased.

Lake Erie & Western.—W. E. Hackedorn, General Solicitor at Indianapolis, Ind., has resigned.

Lake Shore & Michigan Southern.—The office of Master Mechanic at Buffalo, N. Y., having been abolished, the jurisdiction of Master Mechanic A. A. Bradden has been extended to include the entire Eastern and Franklin Divisions. Effective Dec. 1.

Lehigh & Hudson River.—J. M. Duane has been elected a Director, succeeding Garret A. Hobart, deceased.

Missouri Pacific.—J. T. Stafford, heretofore Acting Division Master Mechanic at Baring Cross, Ark., has been appointed Division Mechanic. Effective Dec. 1. C. A. Sanders has been appointed Assistant Division Master Mechanic, with headquarters at Ft. Scott, Kan., succeeding J. T. Jones, transferred.

New York Central & Hudson River.—C. E. Buchholz has been appointed Supervisor of Track on Sub-Division No. 6. J. H. Silvernail has been appointed Assistant Supervisor and G. R. Wadsworth has been appointed Assistant Engineer at Albany. J. T. McKee has been appointed Superintendent of Dining Car Service, with headquarters at 5 Vanderbilt Ave., New York, effective Nov. 29.

G. W. Vaughan has been apointed Supervisor of Bridges and Buildings on the Eastern Division, with headquarters at New York, N. Y., succeeding W. H. Smith, resigned, and F. L. Brooks, assigned to other duties. Effective Dec. 1.

Pennsylvania Company.—The jurisdiction of G. L. Potter, General Superintendent of Motive Power of the P. C., has been extended over the lines of the Grand Rapids & Indiana, with the title of General Superintendent of Motive Power.

Pittsburgh & Connellsville.—At a meeting of the stockholders held Dec. 4, J. K. Cowen was elected President, succeeding Orland Smith; C. W. Woodford, Secretary; J. V. McNeal, Treasurer, and G. W. Wood, Auditor.

Plant System.—At a meeting of the stockholders of the Savannah, Florida & Western, a subordinate line of the P. S., R. G. Erwin was elected President and S. R. Knott, Vice-President. At the same meeting S. R. Knott was elected a Director.

Sacramento & San Joaquin Valley.—At a meeting of the Directors of this newly incorporated company, John Cross was elected President; Warren Gillelen, Secretary, and Arthur G. Newton, Vice-President. (See RR. Construction column, Dec. 1, p. 836.)

Southern Pacific.—J. W. Mackay has been elected a Director.

Spokane Falls & Northern.—C. Shields, Vice-President at Spokane, Wash., has resigned.

Wabash.—Richard Doyle has been appointed Trainmaster of the Buffalo Division, with headquarters at St. Thomas, Ont., succeeding T. J. Costello, resigned. Effective Dec. 1.

West Jersey & Seashore (Pennsylvania).—At a meeting of the stockholders held Nov. 24, Charles E. Pugh was elected First Vice-President, succeeding Mr. Sewell, and S. M. Prevost was elected Second Vice-President, succeeding Mr. Pugh. Mr. Prevost was also elected a Director, succeeding A. J. Cassatt, resigned.

Wilmington & Weldon.—At the annual meeting of the stockholders held Nov. 22, Waldo Newcomer was elected a Director.

RAILROAD CONSTRUCTION.
New Incorporations, Surveys, Etc.

ALABAMA ROADS.—The Crosby Lumber Co. of Brantly, Ala., is reported building a railroad from Brantly on the Central of Georgia, to run southeast about 15 miles to Elba, terminal of the Southwestern Alabama.

ALBERT LEA & SOUTHERN.—Surveys are reported completed for this line from Lyle, Minn., to run northwest about 30 miles to Albert Lea. W. A. Morin and W. E. Todd of Albert Lea are incorporators. (Oct. 9, p. 701.)

ARKANSAS MIDLAND.—Work is reported in progress for the change to standard gage of 24 miles of this line between Brinkley, Ark., and Pine City.

ATCHISON, TOPEKA & SANTA FE.—The Gulf, Colorado & Santa Fe has completed the cut-off of six miles around Gay Hill, Tex. This was simply a change of grade and did not add new stations to the line. (Official.)

BRITISH COLUMBIA ROADS.—Davis, Marshall & McNeill of Victoria, B. C., are applying for a charter for a line from a point on Vancouver Island to a point south of Upper Campbell Lake on the island, with branches to the Beaver and Salmon rivers.

J. T. Bethune and associates have applied for a charter to build a line from a point on the boundary line at or near the intersection with the Dalton Trail, thence over the Chilkoot Pass to the Indian village of Klukwan, near the Lynn Canal.

Application is being made to the British Columbia Legislature for a charter to build a railroad from a point on Horse Shoe Bay, in the Nanaimo District, to run northwest to a point on Nanaimo Lake, and thence to the head of the Alberni Canal, with a branch to the Cheminus River.

F. K. Higgins of Victoria, B. C., gives notice of application to the British Columbia Legislature for an act to build a railroad from Victoria to Hardy Bay.

Smith Curtis of Rossland, B. C., gives notice of application to the next Legislative Assembly of British Columbia for an act to build a railroad from a point on the Columbia River south of Arrow Lake, to run west via the city of Rossland, Sheep Lake, Princeton and New Westminster to Vancouver.

CALIFORNIA ROADS.—E. V. Spencer, Susanville, is reported interested in a road to run from that place east about 20 miles to Smithen on the Nevada, California-Oregon. Right of way is secured for about two-thirds of the distance.

CANADIAN NORTHERN.—The Town Council and Board of Trade of Port Arthur, Ont., have appointed a committee to meet McKenzie & Mann with regard to a terminal for this company and its subordinate lines, the Ontario & Western and the Port Arthur, Duluth & Western, in that city. It is expected that an arrangement satisfactory to all parties will be made. (Sept. 29, p. 685.)

CANADIAN PACIFIC.—With reference to the proposed charter for a line to New Westminster, B. C. (Nov. 24, p. 818), an officer writes that there is to be no change of entrance into the city of Vancouver. The company merely contemplates the duplication of a short piece of line east of the city.

An officer writes that the extension from the main line at Spences Bridge, B. C., southeast to Kereneos

may be built, but this is not yet decided. (Dec. 1, p. 835.)

The company, according to report, has decided to build from Bruce Point, B. C., on the Crows Nest Pass Line, to Golden.

Improvements of the grades are under consideration on the line between Ottawa, Ont., and Carleton, with a view to a new route between Ottawa and Montreal.

CARROLLTON SHORT LINE.—W. A. McCalla of Tuscaloosa, Ala., has the contract for grading this line from Carrollton, Ala., northeast 10 miles to Reform, on the Mobile & Ohio. John T. Cochrane of Tuscaloosa is President. The line is to be ready for business by Feb. 1. (Aug. 4, p. 560.)

CHESAPEAKE & OHIO.—Lane Bros. & Co., Douglas Gilmore & Co., Shanahan, Serpell & Co., John J. Strang & Co., John L. Pitte and the Ferguson Contracting Co. have the contract for the Greenbrier extension from Whitcomb, W. Va., up the Greenbrier River, 100 miles, via Falling Spring and Marlinton to the forks of Greenbrier River. About 25 miles is graded. No track is laid yet. (Oct. 27, p. 753.) Two tunnels are under construction and the bridge masonry is well under way. (Official.)

Grading is completed on sections one to four, and seven to thirteen, on the Piney Creek Branch from Price, W. Va., southwest 14 miles to a point near Beckley. The entire line is under contract to C. D. Langhorne & Co., Greenwood, Va. No track is laid as yet. The contractors are working about 300 men and expect to have the grading completed not later than March 1. (May 5, p. 323.) Track laying will probably be completed by April 1. (Official.)

CHESTER, PERRYVILLE & STE. GENEVIEVE.—Work is reported resumed at the mouth of the Saline River on the extension of this company's line. It has been completed from Clearyville, Mo., northwest along the Mississippi to the mouth of the Saline River and is to be extended to Ste. Genevieve. (June 30, p. 482.)

CHICAGO & EASTERN ILLINOIS.—Press reports state that the company does not expect to have the Eastern Illinois & Omaha extension from Marion, Ill., southwest 62 miles to Thebes, on the St. Louis Southwestern, completed before Dec. 1. About 10 miles of track was laid up to the last of September. (Sept. 22, p. 667.)

CHICAGO & NORTHWESTERN.—A schedule went into effect Dec. 3 for trains to run from Eagle Grove, Ia., via Mason City and Fort Dodge to Mason City, and thence northwest from the Iowa, Minnesota & Northwestern northwest 59.1 miles to Blue Earth, Minn., which line is just completed. (Oct. 13, p. 719.) The intervening stations are: Wheelerwood, Hanlontown, Joice, Lake Mills, Scarville, Kiester, Bricelyn, Frost and Marna. (Official.)

CHICAGO, BURLINGTON & QUINCY.—Kilpatrick Bros. & Collins are reported to have the contract for the extension from Toluka, Mont., on the main line, to run southwest about 110 miles to Cody, Wyo. Grading is to be begun at once. (Oct. 27, p. 753.)

CHICAGO, DUBUQUE & OMAHA.—This company has been incorporated in Iowa to build the road already noted under Dubuque & Omaha (Dec. 1, p. 835), to run from Dubuque southwest across Iowa to Omaha, Neb. B. E. Lineham of Dubuque, Ia., is President, and O. S. Meyers, Secretary.

CHICAGO, INDIANAPOLIS & LOUISVILLE.—An officer writes that the company has not bought coal lands near Linton, Ind., to be connected with short branches. (Nov. 24, p. 818.)

CHICAGO & NORTHWESTERN.—Right of way is being secured, according to report, for an extension northwest in Minnesota, of the new line which now runs to Vesta.

CHIHUAHUA & PACIFIC.—Over 80 miles of track is reported laid and in operation on this line from Chihuahua, Mex., west 124 miles to Guerrero. Edward S. Safford of Guerrero, Mex., is Chief Engineer. (Oct. 20, p. 737.)

COLORADO & SOUTHERN.—Surveys are reported in progress for a cut-off betwen Superior and Boulder, Colo., to run north of Marshall. This will shorten the distance between Boulder and Denver by about two miles and cut out Marshall. The company will build an extension to Cripple Creek, Colo.

CUBAN ROADS.—Press reports state that a railroad is being built to connect the mines at Guama in the Province of Santiago de Cuba, with Chiriviri, five or six miles away on the coast and about 35 miles west of Santiago.

DANVILLE, PAXTON & NORTHERN.—This company was incorporated in Illinois, Dec. 2, with a capital stock of $100,000, to build from the south line of Vermillion County northeast through Danville and Paxton to the north line of Ford County. The incorporators are: Charles Bogardus, Paxton, Ill.; Wm. P. Cannon, Gus M. Greenebaum, M. E. King and George T. Buckingham, of Danville, Ill.

DELAWARE, LACKAWANNA & WESTERN.—Double tracks are being laid, according to report, on the Keyser Valley Branch.

An officer writes that the company does not expect this year to do any double tracking from Bloomfield, N. J., to Montclair. Plans are made for raising the tracks from Bloomfield, though no time has been decided upon for commencing the work.

DENVER & RIO GRANDE.—Grading is completed for 15 miles and track laying for nine miles on the Rio Grande, Pagosa & Northern line from Pagosa Junction, Col., northeast 33 miles to Pagosa Springs. W. C. Bradbury & Co. of Denver, Col., have the contract for the first 17 miles. No other contracts will be let until spring. (Sept. 1, p. 619.)

The cut-off from the main line west of La Veta, Col., to Wagon Creek east of Alamosa, 25.8 miles, is completed and in operation. (Official.)

DES MOINES, IOWA FALLS & NORTHERN.—This company has been organized in Iowa to build a north and south line to rival the proposed Duluth & New Orleans. (See below.) Contracts are reported let for the section from Des Moines, Ia., north about 125 miles to Osage. L. N. Cummings of the Chicago Loan & Trust Co. is the organizer.

DULUTH & NEW ORLEANS.—The contract is reported let for grading a portion of this line in Iowa between Des Moines and Nevada. The road is projected to run from Duluth, Minn., south through Iowa. S. V. Wardell of Ames, Ia., is President. (Nov. 17, p. 800.)

EL PASO & OBSCURA.—This company, according to report, has been formed to build a railroad from El Paso, Tex., north about 140 miles to mineral deposits.

ERIE EASTERN.—J. F. Downing of Erie, Pa., the new President of this company, writes that this line is to be built only provided the right kind of a franchise is granted by the city of Erie, so that the proper harbor facilities can be secured. He does not expect any active operation before next spring. (Nov. 17, p. 800.)

FINDLAY, FORT WAYNE & WESTERN.—An officer writes that there is nothing to announce at present as to the reported extension this winter from Findlay, O., to Tiffin. (Nov. 24, p. 819.)

FLORENCE & CRIPPLE CREEK.—Track laying is reported in progress on the extension from a point seven miles beyond Florence, Col., west eight miles to Canyon City. (Sept. 8, p. 633.)

GULF & MANITOBA.—Track laying is reported begun from a point on the Minneapolis & St. Louis near North Redwood to Beaver Falls, and the company expects to have trains running on this section by Feb. 1. The road is projected from a point on the Iowa State line via Jackson, Ia., to Sauk Center and thence to Duluth, Minn. E. E. Carpenter of Canton, S. D., is an incorporator. (Oct. 13, p. 719.)

GULF & SHIP ISLAND.—C. D. Smith & Co. of Birmingham, Ala., have the contract, according to report, for the last 35 miles of the extension to Jackson, Miss., the work to be completed by April 1. (Nov. 24, p. 819.)

LAKE ERIE & WESTERN.—An officer writes that there is no truth whatever in the report that the company will extend its line from Connersville, Ind., southeast to Cincinnati, O. (Nov. 24, p. 819.)

LOUISVILLE & NASHVILLE.—The company is reported rebuilding the short line from Bradford, Ala., to the furnace at Trussville.

A branch line will be built, according to report, from the main line at Reed's Gap, Ala., 23 miles north of Birmingham, to run through the heart of the Warrior coal fields, 30 miles.

MARYLAND ROADS.—The Bear Creek Lumber Co., according to report, has built a railroad from Friendsville on the Baltimore & Ohio, to a point in Garrett County known as Klondyke.

MEXICAN INTERNATIONAL.—A record of the final survey has been filed for the extension from Durango, Mexico, to the Pacific coast. A large force is building the Durango end. The road is controlled by C. P. Huntington and associates. (Sept. 15, p. 650.)

MEXICAN NORTHERN & INTERNATIONAL.—A railroad under this title is proposed in southeastern Mexico to connect the four cities of Chiapas, Tabasco, Campeachy and Yucatan. It will be about 660 km. (410 miles) long and will cost about $14,000,000. It is stated that the Federal Government will give a subsidy of $6,000,000.

MINERAL RANGE.—The company has completed the Grasse Painte extension from Arcadian Junction, Mich., to Arcadian Mill, 86 miles, with a two-mile branch to Arcadian mine. (March 17, p. 197.) Balch & Peppard of Minneapolis were the contractors. (Official.)

MISSISSIPPI ROADS.—The L. N. Dantzler Lumber Co. is reported building a railroad to connect its lumber lands with its mills at Moss Point.

MONONGAHELA & WASHINGTON.—Grading is reported almost completed on this line from Monongahela City, Pa., southwest 12 miles along Pigeon Creek Valley, Washington County, to Ellsworth. D. F. Keenan of Philadelphia has the contract. J. B. Bott of Philadelphia is Chief Engineer. (Sept. 8, p. 632.)

MONTANA.—There are about 125 men at work on the extension from Martinsdale east 24 miles to Merino, Mont. The maximum curvature is about 1°. The work is very light. There is one bridge of 60 ft. span. Cook & Woldson of Helena, Mont., have the contract for grading and bridging. (Dec. 1, p. 835.)

The company does not contemplate building extensions as reported (Nov. 17, p. 801), from Merino, Mont., to Billings, Great Falls and Lewistown. (Official.)

MONTOUR & GREGG.—This company, recently incorporated in Pennsylvania, is to build a line three miles long from Gregg Station to Montour, in the interest of the Mansfield Coal & Coke Co., Carnegie, Pa. James T. Armstrong of Grenshaw, Pa., is President, and David Boden of Carnegie, General Manager. (Nov. 24, p. 819.)

MORENCI & SOUTHERN.—Surveys are reported completed and grading is to be begun soon on this line from Morenci, Ariz., south 20 miles to Gutrie, on the Arizona & New Mexico. It is owned by the Detroit Copper Co. of Morenci. (Oct. 27, p. 753.)

NASHVILLE, CHATTANOOGA & ST. LOUIS.—An officer writes that the company does not contemplate building at present a new yard at Chattanooga, Tenn., as reported. (Nov. 24, p. 819.)

NEW YORK & BERKSHIRE.—This is the title of the road recently referred to under Massachusetts Roads (Nov. 24, p. 819) as being incorporated in Massachusetts. It is to run from Springfield west about 50 miles through southwestern Massachusetts to Copake, N. Y., on the Central New England. Preliminary and locating surveys are made. The work will be difficult. H. F. Keith of Mount Washington, Mass., is Chief Engineer. (Official.)

This seems to be practically the same project that has been before the Massachusetts Legislature for several years.

NORTH CENTRAL.—The maps and plans have been filed in Arkansas for this company's line from Winnerva, Baxter County, to run west 50 miles to Oregon, Boone County. W. E. Winner of Kansas City, Mo., is one of the chief promoters. (Dec. 1, p. 835.)

NORTHERN PACIFIC.—A contract is reported let for building a branch from Missoula, Mont., to Camas Prairie in the Bitter Root Valley.

NORTHWESTERN & EASTERN.—This company was incorporated in Ohio Dec. 2 to build a railroad from Toledo west to Benton Harbor, Mich. C. C. Wilson of Toledo, and H. H. Dallin, a railroad contractor of Chicago, are among the incorporators.

OHIO ROADS.—A company has been incorporated in this State, with a capital stock of $10,000, to build a line from Cleveland south via West Salem, Wayne County, to Cincinnati. The principal office is West Salem. F. G. McAuey and Allen Greeley are among the incorporators.

J. L. Francis of Chicago, and Harry L. Foltz of New York, are reported to have secured right of way for a line from East Liverpool to run northwest about 18 miles to Lisbon.

OREGON SHORT LINE.—The entire line is graded for the St. Anthony Branch from Idaho Falls, Idaho, northeast 37.2 miles via Elva, Rigby, La Belle, Texas. Rexburg and Teton to St. Anthony. Track is laid from Idaho Falls to Rexburg, 26.6 miles, and was to be completed to St. Anthony by Dec. 5. Corey Bros. Co. of Ogden, Utah, have the contract. (Oct. 20, p. 737.)

Surveys are completed, but no work authorized as yet on the cut-off (Sept. 1, p. 620) from Orchard to Boise City, Idaho, requiring a change of about 30 miles. (Official.)

OSHKOSH & STEVENS POINT.—Contracts are soon to be let for this line from Oshkosh, Wis., northeast 71 miles via Pysippi and Pine River to Stevens Point. (Nov. 3, p. 769.) W. H. Fisher is President. J. W. Edwards of Winneconne, Wis., is interested. (Official.)

PATTEN, ALLEGASH & NORTHERN.—Track is laid for less than one mile on this line from Patten, Me., northern terminus of the Patten & Sherman, to run northwest 70 miles via Mt. Chase, Grand Lake, Chamberlain, Eagle and Churchill Lake to Musaskas Lake. Locating surveys are made for 12 miles to Shin Ponds and the surveys will be completed this winter and spring. No grading is to be done during the winter. (March 3, p. 161.) Albert A. Burleigh of Houlton, Me., is President, and P. C. Newbegin of Patten, Chief Engineer. (Official.)

PENNSYLVANIA COMPANY.—An officer writes that nothing is authorized as to improvements on the Pittsburgh, Cincinnati, Chicago & St. Louis between Dinsmore Tunnel and Wheeling Junction, on the main line, including a number of cut-offs. (Nov. 17, p. 801.

Grading is 80 per cent. completed, but no track laid on the extension of double track from Winslow, Ind., to Wanatah, six miles; Adams, Ind., to Elida, O., 47 miles, and from Lafayette, O., to Dunkirk, 13 miles. Dorwin Young & Co., Chicago, have the contract. (Sept. 1, p. 620.)

Grading is entirely completed and nearly all the track laid on the four-track line from Avalon, Pa., to Baden, about 14 miles. (Official.)

The company has completed its second track from Wilson, Pa., to Kane, 7.43 miles. (Official.)

PEORIA & PEKIN UNION.—Request is made for additional right of way on Grove St. in Peoria, Ill.

PORTLAND, VANCOUVER & YAKIMA.—Surveys are completed and most of the right of way obtained for an additional 80 miles of this line. It was projected from Vancouver, Wash., northeast 170 miles to North Yakima. Of this 17 miles is in operation and an early extension of 20 miles is contemplated. The road is successor to the Vancouver, Klickitat & Yakima. (Aug. 11, p. 576.) L. Gerlinger of Vancouver, Wash., is President. (Official.)

QUINCY & EASTERN.—Surveys are reported completed for this proposed line from Quincy, Ill., east via Rushville to Havana. Terrance A. Clark of Quincy, Ill., is the promoter.

RICE LAKE, DALLAS & MENOMINIE.—The company is building 20 miles of the proposed extension from Cameron, Wis., north about 32 miles via Barron and Dallas to Monominie. Further extensions will be made during the next season. (Sept. 1, p. 620.)

RICHMOND & TIDEWATER.—The counties of King, Queen, Essex, Middlesex and Gloucester have each voted $30,000 subscriptions for this line from Ellerson, Va., near Richmond on the Chesapeake & Ohio, to run east about 60 miles to tidewater in Gloucester and Mathews counties. Fairfax C. Christian of Richmond is interested. (Nov. 24, p. 819.)

RICHMOND, PETERSBURG & CAROLINA.—Grading is completed on the entire line from Petersburg, Va., to Ridgeway, N. C., 77 miles, and the company expects within the next week to have all the track laid with the exception of the bridge across one of the smaller rivers now approaching completion. The line from Petersburg, Va., to Richmond, 25 miles, is to be finished by Jan. 1. Some 2,000 ft. of temporary wooden viaduct will be built at Richmond to prevent delay, but this will be replaced by steel as soon as the material can be delivered. This viaduct is necessary to give the S. A. L. connection north of the city with the Richmond, Fredericksburg & Potomac. (Nov. 10, p. 788.)

RIO GRANDE, SIERRA MADRE & PACIFIC.—Grading is reported begun on the extension from Cases Grandes, Mex., to run through the mineral regions of the Yaqui gold country, 80 miles. (Aug. 11, p. 576.)

RIO GRANDE WESTERN.—Grading is reported begun on the San Pete & Sevier branch from Belknap, Utah, south eight miles to Marysvale. (Dec. 1, p. 836.)

ROCKINGHAM & WEST VIRGINIA.—This company has been organized to build a railroad from Gordonsville, Va., on the Chesapeake & Ohio, to run about 75 miles via Elkton and Harrisonburg to Franklin, W. Va. The section of the Chesapeake & Western between Elkton and Harrisonburg, it is stated, will form a portion of the line. James Negley, 141 Broadway, New York, of the Richmond, Petersburg & Carolina line of the Seaboard Air Line, now building, is President.

SAN FRANCISCO & SAN JOAQUIN VALLEY.—Thirty-five miles of track is reported laid on the extension from Stockton, Cal., west 69 miles to Point Richmond. Track laying is to be resumed between Cornwall and Point Richmond. (Nov. 24, p. 820.)

SOUTHERN PACIFIC.—The company is locating a portable rock crusher at Truckee, Cal., to make a

stone ballast road-bed on the Central Pacific line between Truckee and Rocklin, about 97 miles.

TOLEDO & OHIO CENTRAL.—A proposition has been made by this company to the Board of Public Works of Columbus, O., to raise the tracks and the levee along the Scioto River in that city.

UNION & GREEN SPRINGS.—Moore & Co. of Blacksburg, S. C., have the contract for this line from Union, S. C., on the Southern, to run northwest about 15 miles to Glenn Springs. The road is surveyed for three miles. The work is medium. (July 28, p. 548.) Colonel T. C. Duncan of Union, S. C., is President. (Official.)

VANCOUVER & LULU ISLAND.—Application is made to the British Columbia Legislature for an act to extend the time of completing this proposed line.

VANCOUVER & NORTHERN. — Application is made to the British Columbia Legislature for an extension of time for this line from Vancouver, B. C., to a point on the north or south side of the Fraser River near New Westminster, and to change the name of the road to Vancouver, Westminster & Northern.

VICTORIA-CHILLIWACK.—A committee, headed by J. A. Sayward of Victoria, B. C., has petitioned the Mayor and aldermen of that city to pass a bill authorizing the city to subscribe for $500,000 of capital stock in this company, which proposes to acquire the Victoria & Sidney, which runs between those two cities, and to extend the same for connection with the mainland.

VIRGINIA ROADS.—The Empire Steel & Iron Co. of New York, according to report, has made surveys for a road from Lexington, on the Baltimore & Ohio, to run north about 13 miles to Goshen. J. W. Anderson of Lexington is Engineer.

WARREN & CORSICANA.—This company has been incorporated in Texas, with a capital stock of $100,000, to build a railroad from Warren, Tyler County, on the Southern Pacific, to run northwest about 159 miles to Corsicana. The principal office is Houston, Tex. Among the incorporators are James I. Campbell of Harrison County, and James N. Johnson of Tyler County.

WAYCROSS AIR LINE.—Surveys have been completed, but no contracts let for the company's extension from Douglas, Ga., northwest to Fitzgerald. There are about 60 men at work on clearing and grading, and the company will probably have about 150 more in a week. It is proposed to finish the 12 miles beyond Douglas within the next 90 days. The maximum grade is 0.9 of 1 per cent., and the maximum curvature 3°. There will be about 60,000 yards of excavation and embankment, very little trestling of importance, and no bridging of any kind. The company has sufficient rail to build 10 miles. Negotiations are in progress for the sale of bonds to complete the road to some point northwest. (Oct. 27, p. 754.) The present extension is being built with money subscribed by the owners. (Official.)

WHITE PASS & YUKON.—This company has recently bought $300,000 worth of rails to extend its line from Lake Bennett to Closeleigh, four miles below White Horse Rapids. Of this 2,400 tons are to be delivered under rush orders to Lake Bennett, which line is to be finished by June 1. (Nov. 3, p. 777.)

WILMINGTON & WEST CHESTER.—This company was incorporated in Pennsylvania Nov. 27, with a capital stock of $60,000, to build a line 9¾ miles long from West Chester south via Thornberry, Darlington Corners, Dilworthtown, Painters' Cross Roads and Elam, to the Delaware State line. James H. Hoffecker, Jr., of Wilmington, Del., is President. The directors are: C. G. Brown, Leonard E. Wales, Jr., Francis H. Hoffecker, Wilmington, Del., and Carl R. Williams, Philadelphia.

YELLOWSTONE PARK. — The extension from Hoffman's Mine, Mont., to the Lower Trail Creek Mine covers about four miles of new track. Contracts are already let and work is nearly completed. (Nov. 17, p. 802.) The company expects to have the line ready for operation by Jan. 1. (Official.)

GENERAL RAILROAD NEWS.

BOSTON & MAINE.—The Massachusetts Railroad Commissioners have authorized the issue of 26,835 shares of additional stock to acquire the capital stock of the Portsmouth & Dover, the Portland, Sago & Portsmouth, and the Portland & Rochester. (Oct. 20, p. 738.)

CHARTIERS CONNECTING.—The stockholders at Pittsburgh Dec. 5 voted to merge this line into the Chartiers Ry. It is a connecting line of only 0.72 mile in length and is operated under lease by the Chartiers Ry. for the Pittsburg, Cincinnati, Chicago & St. Louis line of the Pennsylvania Co.

CHICAGO & EASTERN ILLINOIS.—Three bonds for $1,000 each, and one bond for $500 of the Indiana Block Coal RR. Co., have been drawn for payment for the sinking fund at the office of the Farmers' Loan & Trust Co., New York, interest to cease Jan. 1, 1900.

CHICAGO & NORTHWESTERN. — In connection with the extension from Mason City, Ia., to Blue Earth, Minn., whose opening is noted this week (see Railroad Construction column), a contract has been made with the Mason City & Fort Dodge for the use of its tracks between Mason City and Eagle Grove, where connection is made with the C. & N. W. By the terms of the contract, the C. & N. W. will operate through freight over this line, but will not be permitted to transport local freight.

CHICAGO, PEORIA & ST. LOUIS.—A foreclosure sale of this line, and of the St. Louis, Chicago & St. Paul, set for Nov. 27, hase been postponed upon application of the bondholders' committee, until Dec. 18. (Oct. 20, p. 738.)

CLEVELAND & PITTSBURGH.—Sealed proposals will be received up to Dec. 30 at the office of Winslow, Lanier & Co., New York, for $50,000 general mortgage bonds of the company at a price not to exceed par and accrued interest.

DENVER & SOUTHWESTERN.—Judge Stimson of the District Court of Teller County, Col., on Nov. 29 issued three temporary injunctions on motion of Attorney-General Campbell, to prevent the consolidation of the several lines under this title. (Nov. 17, p. 802.)

LICKING RIVER.—This company has been incorporated in Kentucky, with a capital stock of $50,000, to take over the property of the Licking Valley, which already has built 19 miles of road, and to complete the line from Midland, Ky., on the Chesapeake & Ohio, to West Liberty, about 40 miles. The road was reported sold in October. (Oct. 27, p. 754.)

MISSOURI, KANSAS & TEXAS.—Judge Williams of Arkansas in the Federal Court at Fort Scott, Kan., on Nov. 24, sustained a motion to dismiss the suit of Mary P. Steven and others, stockholders of the Kansas City & Pacific, whereby they sought to enjoin the M., K. & T. from absorbing their road by consolidation. In view of this decision, the M., K. & T. has given notice to the New York Stock Exchange of a proposed increase of $2,500,000 in its capital stock, to be used in consolidating the Kansas City & Pacific.

NORFOLK & SOUTHERN.—The stockholders will hold a special meeting Jan. 4 to consider a proposition to sell its road to the Norfolk, Virginia Beach & Southern. (Nov. 3, p. 770.)

PITTSBURGH & WESTERN.—The Baltimore & Ohio on Nov. 28 filed an answer to the suit brought against it and the P. & W., by A. Foster Higgins and others, to restrain the B. & O. from voting 130,000 shares of P. & W. stock. The answer denies that the earnings of the P. & W. were sufficient to meet the interest in the first mortgage lien given to secure an issue of $10,000,000 bonds. Coupons on $1,360,000 second mortgage bonds have not been paid since November, 1895. It is denied that the increase of the common stock of the P. & W. by $1,500,000 was illegal. The Court is asked to dismiss the bill. (Oct. 27, p. 754.)

PULLMAN'S PALACE CAR.—At a meeting of the stockholders held at Chicago, Dec. 5, the action of the Board of Directors was ratified in buying the property of the Wagner Palace Car Co. The capital stock was increased from $54,000,000 to $74,000,000, and the name of the company changed from Pullman's Palace Car Co. to the Pullman Co. The number of directors was increased from seven to eleven. The new directors are: W K. Vanderbilt, J. Pierpont Morgan, F. W. Vanderbilt and W. Seward Webb. The old Directors are Marshall Field, Robert T. Lincoln, Norman B. Ream, John W. Doane, O. S. A. Sprague, Henry C. Hulbert, Henry B. Reed. (Dec. 1, p. 836.)

RALEIGH & GASTON.—The stockholders of this line of the Seaboard Air Line, who were to meet last week at Raleigh, N. C., to consider the consolidation into the company of the various subordinate lines, have postponed the meeting until Dec. 9. (Nov. 3, p. 770.)

ST. LOUIS, CHICAGO & ST. PAUL.—See Chicago, Peoria & St. Louis.

ST. LOUIS, PEORIA & NORTHERN.—Official announcement is made that on Dec. 1 the line between Springfield, Ill., and Glen Carbon, 85 miles, with trackage to St. Louis, 17 miles, over the Chicago, Peoria & St. Louis and the Merchants' Bridge are transferred to the Illinois Central. The line between Springfield, Ill., and Peoria, 63 miles, has passed under the control of the Chicago & Alton. This property was recently acquired by E. H. Harriman and others interested in the Chicago & Alton, and is also known as the Chicago & Northern Short Line. (June 30, p. 484.)

SOUTHERN. — Fifty Georgia Pacific equipment mortgage bonds of July 17, 1889, have been drawn for the sinking fund for payment at the Central Trust Co., New York, interest to cease Feb. 1, 1900. (June 9, p. 418.)

SOUTHERN PACIFIC.—A San Francisco dispatch states that the Huntington-Spayer syndicate has bought 140,000 shares of Southern Pacific stock from General Thomas H. Hubbard, representing the holdings of Edward F. Searles, at the reported price of $40 per share. The same syndicate recently bought 280,000 shares from the Crocker estate and 285,000 shares from the Stamford estate. (Nov. 24, p. 820.)

STATE LINE & SULLIVAN.—Five bonds for $1,000 each have been drawn for payment at 105 at the office of the Union Trust Co., New York, interest to cease Jan. 1.

STATE UNIVERSITY.—A press report from North Carolina states that the temporary receivership has been adjusted to the satisfaction of all parties concerned and Judge Brown has discharged the receiver. (Dec. 1, p. 836.)

WEST VIRGINIA CENTRAL & PITTSBURGH.—As to the reported consolidation of the Davis Coal & Coke Co. with the railroad company, an officer states that the matter has not gone beyond an informal agreement to the plan by a large proportion of the stock of both companies, and the time has not been determined as yet for formal action. The railroad company will probably issue stock to acquire the property of the Coal Company.

WISCONSIN & WESTERN.—This company was incorporated in Wisconsin Nov. 22, with a capital stock of $600,000, as successor to the Kickapoo Valley & Northern, which property was sold at public auction Oct. 2. The incorporators, all of whom are stockholders in the old line, are: Horace A. J. Upham, William E. Black, William S. Fish, Charles S. McClure, Charles W. Norris, Edward J. Paul and Henry J. Droppers, all of Milwaukee, Wis. (Nov. 24, p. 820.)

TRAFFIC.

Traffic Notes.

The reporters in New York City say that there is some secret cutting of freight rates by the roundabout lines to Kansas City. Numerous reductions of about 10 to 15 per cent. are reported.

The Railroad Commission of Arkansas has ordered the railroads of the State to send to the Commission monthly an abstract of all freight billed through to or from foreign roads, showing each road's proportion of the earnings.

The Merchants' Association of New York has secured from the Trunk Line Association a reduction in passenger fares for retail merchants coming to New York between March 16 and March 21, from April 3 to April 6, with a return limit of 15 days.

The Columbus (O.) Car Service Association has notified consignors and consignees that hereafter all freight taking carload rates will be subject to demurrage charges. Freight taking carload rates will not be taken into freight houses, either inbound or outbound. Consignees are notified that incoming L. C. L. freight is liable to be sent to public warehouse after five days.

At the hearing held by the New York State Commerce Commission in Duluth, Minn., last week, Mr. Thompson, a leading grain shipper, said that Boston and Montreal had for several years been gradually taking export business away from New York. Formerly Mr. Thompson sent half his grain by way of New York, but now he sends not more than one-quarter that way. He thinks that if the people of New York desire to increase their proportion of the export grain business, they will have to provide means for transferring grain from the cars to the ocean steamships at 2½ mills a bushel. He had had no cause for complaint of delays at Buffalo.

The Industrial Commercial Congress.

This is the name of the association formed at Chicago recently for the purpose of securing action by Congress modifying the Interstate Commerce Law. It is said to be composed of the following trade bodies: Millers' National Association; National Business League; National Board of Trade; National Association of Manufacturers; National Transportation Association; National Live Stock Exchange; United States Brewers' Association; Carriage Builders' National Association; Vapor Stove Manufacturers' National Association; Heavy Hardware Jobbers' Association; National Wholesale Grocers' Association; National Wholesale Lumber Dealers' Association.

The Secretary, Mr. Frank Barry, says that Senator Cullom already has a bill drafted, which will be presented in the Senate, embodying the following requirements: The publication of export and import tariffs and terminal facilities; tariffs to be changed only on notice of 60 days, but the commission is given some latitude in modifying this requirement, and also requirements as to the posting and publications of tariffs. A section has been added providing for a uniform classification. The criminal section is so changed that the corporation as well as the individual is made liable; the imprisonment feature of the old law is eliminated; the shipper is not made liable except in cases where he has been guilty of some actual fraud. It is provided that the Commission, when it determines that the carrier is in default, may prescribe the thing that shall be done by it. When a discrimination exists the Commission may say what rate shall be charged to remove that discrimination. A penalty is imposed upon carriers if they do not return their annual reports within a prescribed time limit. The Commission is given power to examine accounts by special agents.

The Stock Yards Switching Charge.

In the United States Circuit Court at Chicago, Dec. 4, Judge Kohlsaat handed down a decision holding that the charge of $2 a car imposed by the railroads for delivering live stock to the Union Stock Yards, is reasonable. This reverses a decision of the Interstate Commerce Commission.

Grain Receipts at New York.

The receipts of grain at New York for the season from May 1 to Dec. 4 this year amounted to 107,847,960 bushels, as compared with about 112 millions in 1898 and 121 in 1897. The receipts of wheat increased over 50 per cent. (from 30 millions to 46 millions), but corn fell off from 35 to 27. Canal boats brought a larger percentage of the grain this year than last, chiefly in consequence, apparently, of the better movement of wheat this year. Of corn the canal carried a much smaller proportion this year than last. Total receipts by canal of all grain were 16,771,600; by rail, 91,076,360.

Chicago Traffic Matters.

Chicago, Dec. 6, 1899.

The Rock Island now makes rates on live stock from west of the Missouri by the hundred pounds instead of by an assumed carload weight. The new rule will have no effect on Texas shipments, as the 100-pound rate has been in effect from that State for some time.

A one-way second-class rate of $17 has been put in between St. Paul and New York via Chicago. While the St. Paul-Chicago lines have openly authorized this rate, it is not known what, if any, eastbound road is joining in it. Officers of the Grand Trunk have several times put themselves on record as standing ready at all times to meet Canadian Pacific competition.

Recently, Rev. Mr. Walker, the Episcopal clergyman of Joliet, Ill., was sent an annual half-fare permit over the Western roads with a notation that the permit was in the nature of a courtesy. Mr. Walker has returned the permit with a letter to the effect that he will not accept a permit in this way, but demands one as a clergyman, without any courtesy provision. Mr. Walker is the gentleman who was refused a permit a year ago by the Joliet roads because of his public utterances on the question of abolishing grade crossings in Joliet. He carried his case to the Interstate Commerce Commission, which body recently suggested to the officers of the lines concerned that if they would send Mr. Walker a permit the case might be dismissed.

Eastbound shipments of flour, grain and provisions from Chicago and Chicago junctions to and beyond the western termini of the trunk lines for the four weeks ending Dec. 2 amounted to 411,525 tons, compared with 389,856 tons for the corresponding period of last year. This statement includes 34,117 tons of flour, 308,339 tons of grain and 68,949 tons of provisions. The following table shows the quantities and proportions carried by the respective roads.

Roads.	Tons.	Per cent.
Baltimore & Ohio	49,679	12.2
Clev., Cin., Chi. & St. Louis	19,669	4.3
Chicago & Erie	34,701	8.1
Grand Trunk system	30,501	7.2
Lake Shore & Mich. South	70,294	17.4
Michigan Central	37,604	9.1
New York, Chic & St. Louis	45,399	11.1
Pitts., Cinn., Chic. & St Louis	27,880	6.2
Pitts., Ft, Wayne & Chic	68,595	16.3
Wabash	36,863	8.1
Total	411,525	100.0